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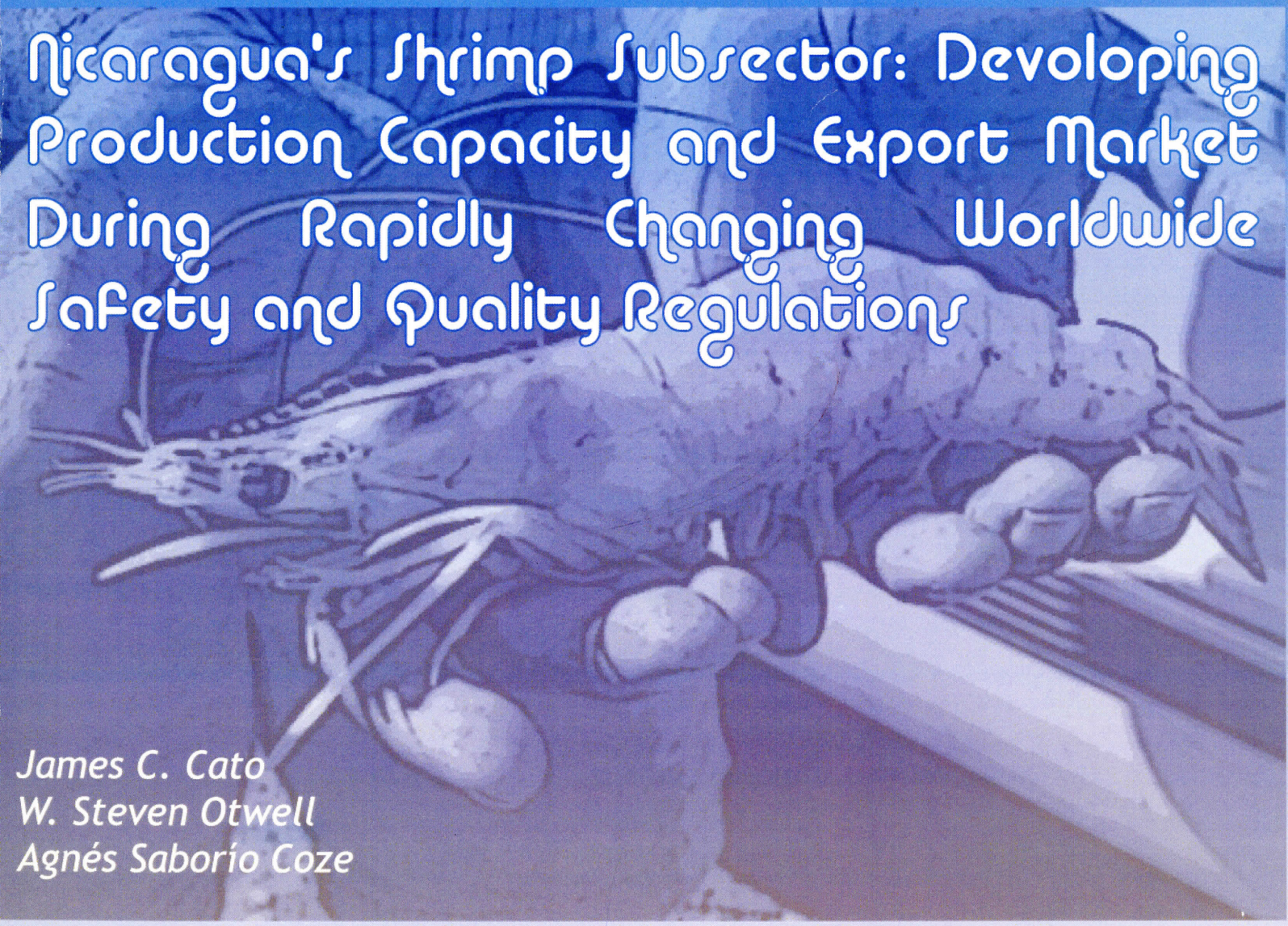
CENTRO DE INVESTIGACIÓN DE ECOSISTEMAS ACUÁTICOS

Nicaragua's Shrimp Subsector: Devoloping Production Capacity and Export Market During Rapidly Changing Worldwide Safety and Quality Regulations



James C. Cato
W. Steven Otwell
Agnés Saborío Coze

UCA
Universidad Centroamericana

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James C. Cato
W. Steven Otwell
Agnés Saborío Coze

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AdPESCA – Administración Nacional de Pesca y Acuicultura
AFDO – Association of Food and Drug Officials
CAF – Central American Fisheries
CIDEA – Centro de Investigación de Ecosistemas Acuáticos

CIPA – Centro de Investigaciones Pesqueras y Acuícola
DANIDA – Royal Danish Ministry of Foreign Affairs
FAO – Food and Agriculture Organization of the United Nations
FENIPESCA – Federación Nicaragüense de Pescadores Artesanales
HACCP – Hazard Analysis Critical Control Point
INATEC – Instituto Nacional Tecnológico
INPESCA – Instituto Nicaragüense de Pesca
JICA – Cooperative Agency of Japan
MAGFOR – Ministerio Agropecuario y Forestal
MARENA - Ministerio del Ambiente y los Recursos Naturales
MIFIC – Ministerio de Fomentos, Industria y Comercio
MINSA – Ministerio de Salud
MITRAB – Ministerio del Trabajo
MTI – Ministerio de Transporte e Infrastrucura
NHP - Necrotizing Hepatopancreatitis
NOAA – National Oceanic and Atmospheric Administration
PCR - Polymerase Chain Reaction
PRADEPESCA (EC) - Programa Regional de Apoyo al Desarrollo de la Pesca en el Istmo Centroamericana (Unión Europea)
PROGOLFO – Proyecto Regional Conservación de los Ecosistemas Costeros del Golfo de Fonseca
TSV – Taura Virus Syndrome
TRABANIC – The Nicaragua Banana Workers
UCA- Universidad Centro Americana
UNAN – National Autonomous University of Nicaragua – Leon
UNICAM – Unión Regional de Cooperativas Camaroneras de Occidente – Nuevos Horizontes
URCOOP – Regional Union of Fisheries Cooperatives
URCOOPRA – Unión de Cooperativas de Productores Acuícolas
URCOCAM – Unión Regional of Cooperativas Camaroneras
URCOPANIC –Unión Regional de Cooperativas Acuícolas y Pesca Artesanal
USFDA – United States Food and Drug Administration
USAID – United States Agency for International Development
WSSV – White Spot Shrimp Virus

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James C. Cato[1], W. Steven Otwell[2] and Agnés Saborío Coze[3]

EXECUTIVE SUMMARY

The Nicaragua shrimp subsector has successfully adapted to international food safety and quality standards. Hazard Analysis and Critical Control Point (HACCP) programs have been implemented. The Nicaraguan government agency for food safety and quality has been recognized as the competent authority. Shrimp are being exported to the United States (US), to member countries of the European Union (EU) and to Japan. There have been no major shrimp safety and quality problems in international trade. However, there are challenges to be faced and needs to be fulfilled within the Nicaragua shrimp subsector that will ensure that this situation continues and that the subsector can grow.

The main challenge for the shrimp industry in Nicaragua is to remain competitive in the international market which is currently experiencing a 20-year low in shrimp prices, while contending with poor infrastructure (e.g., poor roads, lack of waste management, fragile electrical supply) and limited government support. The ability and talent of the industry has been demonstrated in response to numerous natural challenges (Hurricane Mitch, widespread outbreak of shrimp diseases) and general international regulatory scrutiny for product safety. Through these challenges, the industry has learned how to adjust and recover with production and processing methods that both prevent and minimize losses, but this transition and learning phase has left the industry in a fragile economic state.

A major restructuring is underway within the small farm cooperative sector and a new business model may be needed to ensure its survival. While the production from this sector is a small part of overall production, its survival is necessary from a social needs perspective and to maintain the family and community structure that supports the overall shrimp subsector, including processing. This business model needs to be a cooperative effort with a development bank or agency, the small farm sector, the processors and a third-party financial agent.

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[1] James C. Cato is Senior Associate Dean and Director, School of Natural Resources and Environment, Director, Florida Sea Grant College Program and Professor, Food and Resource Economics, University of Florida. P.O. Box 100400, Gainesville, Florida, 32611-0400 USA.
Tel: 352.392.5870 x227 Fax: 352.392.5113 jcato@ifas.ufl.edu

[2] W. Steven Otwell is Professor, Food Science and Human Nutrition and Florida Sea Grant Seafood Technologist, University of Florida. P.O. Box 110375, Gainesville, Florida, 32611-0375 USA. Tel: 352.392.4221 Fax: 352.392.8594 Otwell@ifas.ufl.edu

[3] Agnés Saborío Coze is Directora, Centro de Investigación de Ecosistemas Aquáticos, Universidad Centroamericana, Rotonda Rubén Darío 150 mts. al. oeste, Apartado: 69, Managua, Nicaragua Tel: 505.278.1492 Fax: 505.278.3930 agnes@ns.uca.edu.ni

Major infrastructure needs exist. They include better roads, upgraded water, sewage and electrical systems, better community health care systems and better educational systems. While the effect on the shrimp subsector is indirect, at the same time it is critical to ensure that everyone not only has the education, but the supporting infrastructure that allows safe and high quality shrimp to be produced. The Nicaraguan government needs dedicated seafood quality and safety experts and more and better analytical laboratories. Small farmers need better skills in business and records management and in how to understand and detect potential shrimp safety and quality problems. The processors need assistance in training the producers that supply the shrimp to the plants. The university sector needs more advanced laboratory capability. The production sector needs more capability in analyzing water quality and assistance in disease control ranging from ways to analyze and prevent wild-caught larvae from being a disease vector to creating a closed-system hatchery for larvae which would prevent the introduction of disease from imported larvae. The Nicaragua shrimp industry has the ability to be successful in international commerce, but it needs assistance to reach a self-sustaining position in the current economic climate. An investment in the Nicaragua shrimp industry would be an investment in proven talent and ability to succeed for the welfare of Nicaragua.

1.0 INTRODUCTION

The world market does not need Nicaraguan shrimp, but Nicaragua needs the world shrimp market. One major shrimp contamination event or safety and quality issue can give the Nicaragua shrimp subsector a bad name. The impact on the world shrimp market would be negligible, but the impact on the Nicaragua economy would be substantial. Seafood as a percentage of the total value of exports from Nicaragua has ranged from 11.0% to as high as 19.5%, making it an important part of all product exports from Nicaragua. The value of seafood exports from Nicaragua has ranged from a low of US$51.3M in 1994 to a high of US$123.9M in 2000. Seafood export values increased from 1994 to 2000, but declined in 2001 and again in 2002 to US$65.7M (Appendix Table 1). The value of cultured shrimp has grown from 1.1% of GNP in 1994 to 3.7% in 2001, reaching its greatest contribution of 5.1% in 2000 (Saborío 2002). Shrimp as a percentage of the total value of seafood exports was 50.4% in 2002.

According to the Central Bank of Nicaragua, the Nicaragua fishing sector was tenth nationally in employment generation in 2000. It is also a subsistence activity for a large segment of the population located in riverside and coastal communities. This same year, CIPA/AdPESCA[4] estimated that 41.8 thousand people worked in support of fishing and aquaculture. Fishing activity generated employment for 18,335 people. This included 1,533 working in processing plants, 2,852 were fishermen in the sea-going industrial fleet, 11,650 were fishermen in the coastal artesian fleet and 2,300 worked in support services related to fishing. Aquaculture generated 23,500 jobs, with 5,000 working in commercial companies and cooperatives (mostly in shrimp), 8,000 people worked in storing and catching shrimp larvae and 500 were employed in diverse activities associated with aquaculture. The processing plants generated direct employment to 1,533 people (993 on the Caribbean side and 540 on the Pacific side). Processing plant employment was 683 men and 850 women. An estimated 2,300 people were employed in the area of services that supported fishing and aquaculture (Anonymous 2000).

A developing country can achieve higher levels of development through the production of a food commodity for the world market. However, importers of the food expect that the product meet world or importing country standards for safety and quality. It is critical that Nicaragua and its existing shrimp capture and developing shrimp farming sector achieve the

[4] See Acronyms Used for this and other abbreviations in this document.

highest quality and safety standards possible and put in place the structure and ability to maintain the safety and quality of its exported shrimp product. Nicaragua currently exports about 87% of its output to the US, but this represents only 1% of total shrimp imports into the US. Nicaragua shrimp exports in 2001 represented only 0.46% of the value of worldwide shrimp exports. To put Nicaragua in further perspective, recent annual production equals about 5% of the world's annual growth rate in shrimp production.

Section 2.0 of this document begins with a overview of the external market and regulatory context within which the Nicaragua shrimp subsector operates. Both the current status of the world shrimp market and the changing regulatory context of safety and quality concerns in the major shrimp importing regions are discussed. Section 3.0, Nicaragua shrimp subsector, covers the legal and regulatory context of the sector, analyses recent production and processing data, reviews technical assistance programs provided in Nicaragua, presents shrimp export and foreign trade data, lays out the current status of the sector related to safety and quality issues and estimates the cost of compliance incurred within the sector to achieve necessary safety and quality standards. Section 4.0 focuses on recommendations about additional investments that would assist the subsector not only in safety and quality, but in overall competitive performance and on needed training programs. Section 5.0 provides conclusions drawn from the study and points out some lessons learned during the analysis. Section 6.0 contains the literature cited in the document, Section 7.0 contains the list of people interviewed in Nicaragua for the study and Section 8.0 is the appendix containing detailed shrimp subsector and trade data for Nicaragua.

The core focus of the study was to determine the significance of shrimp safety and quality problems faced by the Nicaragua shrimp subsector. It was also a focus to determine the costs of making sure minimum safety and quality standards were maintained, and to document other problems faced by the developing Nicaragua shrimp subsector. The principal audiences for the study are shrimp importers in the US and in other markets for Nicaragua shrimp, the Nicaragua shrimp industry, policy makers in Nicaragua and other developing countries, trade policy analysts and rural development specialists.

A combination of research methods was used to conduct the analysis whose results are reported in this study. First, the existing literature on the Nicaragua shrimp subsector was reviewed and used as background material. Then, secondary data on the Nicaragua shrimp subsector and export markets were collected from agencies within Nicaragua and from national and international sources in other countries. Structured questionnaires were developed and distributed within Nicaragua to the shrimp processing plants, vessel owners, small shrimp farmers and the government agency with shrimp safety and quality responsibility. The questionnaires were distributed prior to personal visits with all the respondents and completed questionnaires were discussed and revised during the personal visits. Additional personal interviews were conducted with key industry participants and stakeholders. It was also helpful that one of the team members lives in Nicaragua and works with the shrimp industry and the two US-based team members both had prior experience in conducting shrimp related projects in Nicaragua. This gave the team advance knowledge of the Nicaragua shrimp subsector.

2.0 EXTERNAL MARKET AND REGULATORY CONTEXT

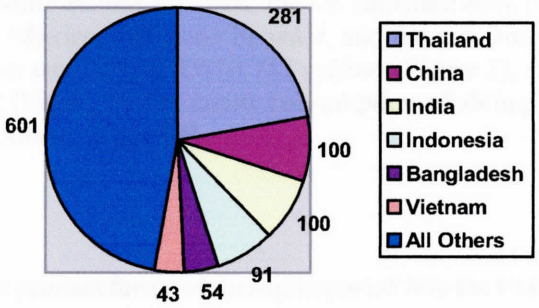
2.1 Market Context

World production of shrimp from both capture and aquaculture harvest has expanded substantially over the last decade, from 1.524 million metric tons (MT) in 1980 to about 3.528 million MT in 2001. China is the leading shrimp producing country at about one-fourth of world

production with Indonesia, India and Thailand the other major shrimp producing countries. These four areas produce approximately one-half the world's total with about 100 other countries producing the rest (Keithly 2003). Overall, the increase in world shrimp production from 1980 to 2001 translates into a growth rate of about 100 thousand MT per year.

Farmed shrimp worldwide was 72.6 thousand MT (5% of world production) in 1980. By 2001, farmed shrimp production was 1.270 million MT (about 35% of world production). The culture or farming of shrimp increased dramatically during the late 1980s, with growth stabilizing during the 1990s due to disease problems in a number of the leading shrimp farming countries. Production from shrimp farming began to increase again in the late 1990s and early 2000s with some growth estimates now at 12-15% per year, depending on the area of production. The leading shrimp farming countries in 2001 were Thailand, China, India, Indonesia, Bangladesh and Vietnam (Figure 1). Ecuador farmed production, normally about equal to that of China, India or Indonesia in recent years, fell by 75% in 2001 due to virus problems. Shrimp capture fisheries have also increased over the last decade. Between 1987 and 1994, production levels of captured shrimp increased marginally each year, with the rate of increase much higher beginning in 1994. The leading shrimp capture countries are China[5], India, Indonesia, Thailand, Vietnam, US, Mexico and Malaysia (Figure 2). Captured shrimp represent about 65% of world production (Keithly 2003).

Figure 1. World production of farmed shrimp by major countries of production, 2001.



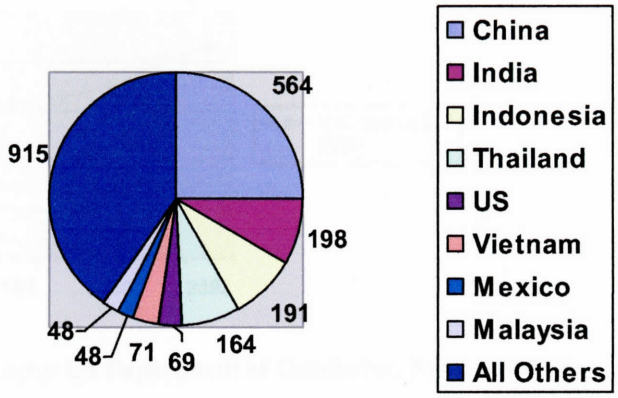
000 Metric Tons

(Source: Keithly 2003)

About 60% of world shrimp production enters world trade with the remainder largely consumed in the country of origin. The value of world shrimp exports in 2001 was US$8.4 billion. In 2001, Thailand, Indonesia, India, Vietnam and Mexico exported about 32% of shrimp volume and 49% of the value of shrimp exports worldwide. (Keithly 2003). The US, Japan and the EU are the three main shrimp market areas. Each of these areas has imported about one-third of the world trade in recent years. While there is some annual variation, Japan was the leading importer until 1994, reaching about US$4 billion, with a decline since that time due to the condition of the Japanese economy. Japan now imports a slightly lower amount than the US and the EU, with these latter two varying from year-to-year regarding which one has slightly higher import values than the other.

[5] All the data are for warm-water shrimp. The data for China may include some cold-water shrimp.

Figure 2. World production of caught shrimp by major countries of production, 2001.

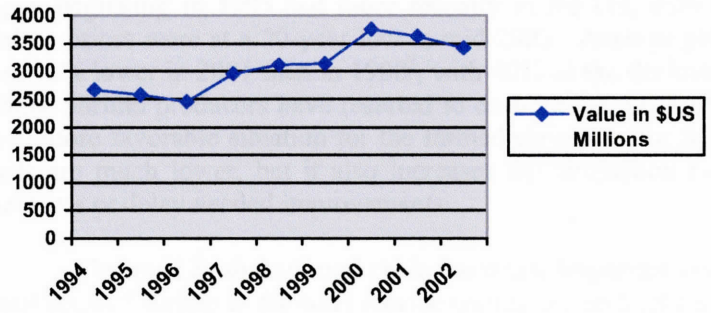


000 Metric Tons

(Source: UN Food and Agriculture Organization)

The US is the major market for shrimp from Nicaragua[6]. The value of shrimp imports from all sources into the US has increased from US$2,668 million in 1994 to US$3,422 million in 2002. Although there is some annual variation, the US imported 69% of its shrimp value in 2001 from Thailand, Vietnam, Mexico, India and Ecuador, and the rest from about 40 other countries. The maximum import year was 2000 at US$3,757 million (Figure 3), although volume continued to increase through 2002 (Figure 4). Per capita consumption of shrimp in the US reached an all-time high in 2001 at 3.4 pounds (Figure 5).

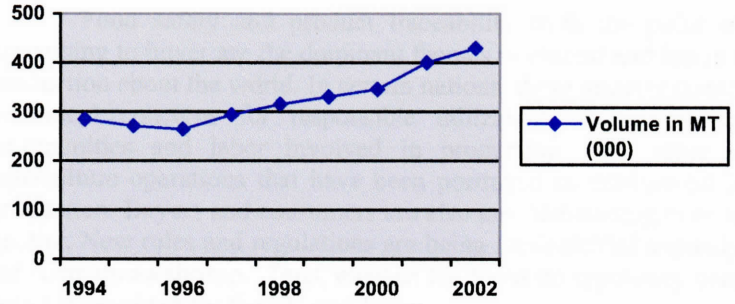
Figure 3. Value of all product forms of shrimp imported into the United States, 1994-2002.



(Source: US Department of Commerce, NOAA, NMFS)

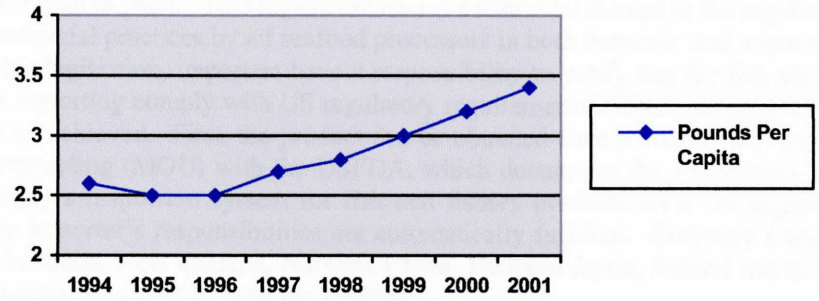
[6] For more detail, see section on Shrimp Exports and Foreign Trade, page 31.

Figure 4. Volume of all product forms of shrimp exported into the United States, 1994-2002.



(Source: US Department of Commerce, NOAA, NMFS)

Figure 5. Per capita consumption of shrimp in the United States, 1994-2001.



(Source: US Department of Commerce, NOAA, NMFS)

Due to continued growth in production, an oversupply condition exists in the world shrimp market. This has led to a steady decline in shrimp prices over a number of years. The oversupply situation has been exacerbated by the condition of the world economy, particularly in Japan beginning in 1995 and more recently in the US, with the resulting situation that world shrimp prices were at a 20-year low in mid-2003. Average price per kilogram of world exports was 50% lower in 2001 than in 1980[7], with 40% of the decline occurring since 1986-88 (Keithly 2003). Shrimp producers have resorted to cost-cutting measures to survive. This has created an even more favorable situation for the farmed shrimp sector in developing countries where labor costs are much lower, but it also increases the temptation to cut corners on safety or quality measures or delay needed improvements.

The trend in shrimp markets in the major importing countries has been an increase in the retail sales of shrimp to the food service sector, i.e., restaurants. Food preparers demand a peeled, cooked product that is packaged to their exact specifications. They want sealed packages, portion control, new presentations and recipes along with new flavors and types of breading on further processed shrimp. Packaging and inventory controls are important. Even retail buyers, a declining market segment, are demanding these type products to reduce at-home preparation times and to increase the ease of preparation.

[7] This comparison is in constant dollars (deflated) to account for the effect of inflation.

2.2 Regulatory Context

Food safety and product traceability from the point of original production through processing to buyer are the dominant themes in current and future regulatory concerns for shrimp production about the world. In certain nations, these primary concerns are being supplemented by additional concerns for responsible utilization of the resources and the welfare of the communities and labor involved in production. This latter theme specifically applies to aquaculture operations that have been portrayed as detrimental in other regions of more mass production. Buyers and consumers are also now demanding even higher levels of food safety and quality. New rules and regulations are being implemented annually. The US is the major market for Nicaraguan shrimp. Thus, most of the focus on regulatory context is placed on the US. Less detail is provided for the EU and Japan.

2.2.1 United States

2.2.2.1 HACCP-Seafood HACCP was implemented in the US in 1998[8] and now all countries that export to the US must have a recognized 'competent authority' government entity to ensure the safety and quality of exported seafood and each plant involved in export must have a HACCP plan in place. This legislation issued a historical change in the regulatory requirements and commercial practices by all seafood processors in both domestic and international operations. Under this legislation, importers have a responsibility to verify that the fish and fishery products they are importing comply with US regulatory requirements[9]. There are two main ways in which this can be achieved. First, the product can be obtained from a country that has a Memorandum of Understanding (MOU) with the USFDA, which documents the equivalency or compliance of that country's inspection system for fish and fishery products with US requirements. In such cases the importer's responsibilities are automatically fulfilled. Currently Canada, Chile, South Korea, Australia, New Zealand, Norway, China, Thailand Japan, Iceland and the EU have agreed or are negotiating an MOU with the USFDA.

Alternatively, the importer can have written verification procedures for ensuring that imported fish and fishery products have been processed in accordance with US regulatory requirements. First, product specifications must be designed to ensure that the product is not adulterated, as defined by US legislation. Second, 'affirmative steps' must be taken to verify that the product has been processed in accordance with US regulatory requirements. The steps that an importer must take are not mandated, but examples include:

- Obtaining HACCP and sanitation monitoring records from the foreign processor to ensure US regulatory requirements have been satisfied.
- Obtaining a continuing or lot-by-lot certificate from an appropriate foreign government inspection authority or competent third party certifying that the imported fish or fishery product is or was processed in accordance with US regulatory requirements.
- Regularly inspecting the foreign processor's facilities to ensure that the imported product is processed in accordance with US regulatory requirements.
- Maintaining a copy of the processor's HACCP plan and a written assurance from the processor that the imported product is being processed in accordance with US regulatory requirements.

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[8] 21 CFR 123, 'Procedures for the Safe and Sanitary Processing of Fish and Fishery Products'. December 18, 1995. (60 FR 65065).

[9] The next six paragraphs rely heavily on US procedures already described in another World Bank document (Henson and Mitullah 2003).

- Periodically testing the imported product and maintaining a written assurance from the processor that the imported product is being processed in accordance with US regulatory requirements.
- Other such verification measures that provide an equivalent level of assurance of compliance with US regulatory requirements.

Importers are entitled to utilize a competent third party to assist with or perform these verification procedures, including preparation of the importer's verification procedures. However, in all cases records must be kept that document the performance and results of the affirmative steps taken. Thus, there must be evidence that all imported fish and fishery products have been processed under conditions that are equivalent to US regulatory requirements. In the absence of such evidence it is assumed that the product is adulterated and entry at the border is denied.

Inspection authorities in some countries are issuing lists of processors that are in 'good standing' and are considered to be processing in accordance with US requirements. Importing from processors on these lists is one way of meeting the requirement to take 'affirmative steps'. However, this does not provide a guarantee of compliance and importers must be confident that they will be considered credible by the USFDA.

The US maintains a system of border inspections to ensure that imports meet the same standards as domestic products. Importers are required to file an entry notice and an entry bond with the US Customs Service pending a decision regarding the admissibility of the product. USFDA is notified by Customs of the arrival of a consignment and makes a decision as to the article's admissibility based on a check of documentation and physical or other forms of inspection. In some instances a product is detained automatically at the border without physical examination. This is based on past history and/or other information indicating the product may not comply with US regulatory requirements. Where non-compliance is widespread, for example across a product category or imports from an entire country, all consignments may be detained.

The HACCP regulation caused a historical change in the regulatory requirements and commercial practices by all seafood processors in both domestic and international operations. To comply, processors have to identify critical control points in their operations that must be monitored to assure that potential hazards are reduced or eliminated such that seafood safety hazards are 'not likely' to occur. In addition, the HACCP regulation mandated daily record-keeping to document routine sanitation practices throughout the entire operation. Monitoring and maintenance of safety and quality control and sanitation records are new and necessary requirements to assure commerce in the United States. These records must be maintained in English at the respective processing facilities and be readily accessible upon request by USFDA at the point of entry into the United States. Likewise, importers are obligated to conduct certain 'affirmative actions' as listed by USFDA in the HACCP regulation. The actions can include on site audits, collection of inspection reports from competent authorities, product sampling and analysis, and/or other actions that provide additional evidence to complement the HACCP records that assure the company is producing safe seafood.

2.2.1.2 Terrorism Impacts-Likewise, new emphasis on food security issues as perpetuated by international concerns for terrorism has initiated additional regulations intended to better identify the product source and condition. International seafood commerce is entering a decade of additional concerns for food safety that could become known as HACCP+. Changes in the US exemplify this situation.

Through September, 2004, the USFDA will be implementing new proposed regulations: 1) registration of all food facilities; 2) prior notifications for imports; 3) additional product detention authority; 4) more processor records accessibility); 5) declared country-of-origin labeling for all foods. The regulations are collectively referred to as the Bioterrorism Act and details can be accessed at www.fda.gov/bioterrorism/bioact/html. These proposed regulations foster more scrutiny and control for product origin and food safety. The Nicaragua shrimp industry should prepare for compliance. There are no production, commercial or regulatory reasons or constraints evident to suggest Nicaragua cannot comply.

By December 12, 2003, all Nicaraguan shrimp processing facilities exporting to the US must be registered with the USFDA. This means that the owners, operators or agent in charge of the facilities that manufacture, process, pack or hold shrimp destined for consumption in the US must submit a registration to USFDA, including the name and address of each facility at which, and the trade names under which, the registrants conduct business, and the categories of food the facilities handle. Each facility will be assigned a unique registration number that will be used to identify the firm's products. Farms are excluded from this requirement, which indicates the essential role of the processors/exporters[10] in Nicaragua. If Nicaraguan firms choose to conduct value-added production they must be mindful that this regulation also exempts foreign facilities that export foods that will undergo further processing or packaging by another foreign facility before it is exported to the US.

Also, by December 12, 2003, prior notice is required by noon of the calendar day before the day the imported shrimp will arrive at the US port of entry. The prior notice will be submitted electronically through USFDA's Internet-based system. Detailed information will be required to accompany each prior notice. This information must include complete identity of the food product, plus the USFDA product code, and the lot or code numbers or other identifiers as appropriate. Nicaragua shrimp production will be subject to more traceability in compliance with this new rule.

The prior notification rule will be complemented by more authority for records access involving information when the foods are received, released or transported. Some of the required information that can be accessed on request includes identity of the non-transporter previous sources, all foods received with name of the firm and responsible individual, addresses, phone numbers, fax numbers and e-mail addresses; type of foods, including brand names and specific varieties; date received, lot numbers or other identification; quantity and type of packaging; and the name, address, phone, fax, e-mail address of the transporter, etc. This information should be accessible for one to two years depending on the perishable nature of the food. This complicated regulation will be more problematic for the buyers and retail operations than the processors, so the Nicaraguan shrimp processor should anticipate this problem and plan to assist their buyers in order to remain competitive with other exporters that will provide similar assistance.

Effective immediately, since the proposed rule was 'self-executing,' an officer or qualified employee of USFDA may order the detention of any article of food that is found during inspection, examination, or investigation if the officer or employee has 'credible evidence' or information indicating the article presents a threat of 'serious' adverse health consequences or death to humans or animals. The wording in this mandate is obviously directed to prevent acts of terrorism, but eventual USFDA practice relative to food imports remains in question. The new rule does extend the detention authority of USFDA and allows for more immediate action. It will

[10] The three shrimp processors in Nicaragua also act as exporters and export their own products.

most likely focus on the more perishable foods rather than the frozen items typical for Nicaraguan shrimp.

By September 30, 2004, all food suppliers will be required to provide information to retailers indicating the country of origin of the covered commodity. Implementation of this rule in terms of public information will rest with the retail sector, excluding food service establishments. The information provided by the suppliers must be maintained in such a manner that it is a verifiable recordkeeping audit trail. There are specific provisions regarding the need for such labeling if the food will be an ingredient in a further processed food or processed in another locale than that of the initial supplier. Likewise, this regulation emphasizes use of distinct labeling for 'farm-raised or wild' fishery products. Nicaraguan shrimp could be subject to distinction as farm-raised or wild relative to the original source mindful that the current processors handle both sources. There could be advantages or disadvantages to this distinction if the intended markets have a preference for the source. In some instances this preference is influenced by traceability for the products and environmentally responsible reputations. Nicaragua shrimp commerce must plan to use this new regulation to distinguish their proven commitments to product safety and quality as well as their responsible efforts for environmental and communal protection.

2.2.2 European Union

The EU has gone to even higher levels of accountability to ensure the safety and quality of the foods it imports. This has also stimulated a high level of interest in estimating the economic costs associated with higher levels of seafood safety and how much consumers will pay for this benefit (Cato 1998). Both the EU and its member countries often inspect individual plants in exporting countries before they are allowed to export to the EU and are demanding higher levels of accountability and traceability. For example, not only do they want to certify the processing plant, in the future they may want documentation to show which farm grew the shrimp and in some cases, which pond on the farm, for each lot of shrimp that is purchased and exported. Recent inspections conducted by the EU and UK-based companies on-site in Nicaragua called for more control and traceability of the farmed production, and more evidence for responsible attention for the resource, environment and laborers. Nicaragua cannot rely on development of production alone to compete in international commerce. And, in some cases they are demanding that the exporting country meet certain levels of social and environmental accountability, e.g., treats its labor force fairly and protects its mangroves and wetlands in an environmentally sustainable way. The inspection, certification and regulatory system in many ways is becoming a 'country to company (or plant)' system as well as a 'country to country' system.

Importing countries also have differing rules and regulations that govern safety and quality. The issue of Sanitary and Phytosanitary (SPS) measures was demonstrated in the EU in January, 2002, when imports of shrimp from China were temporarily banned after traces of the antibiotic, chloramphenicol, were detected. Subsequently, another antibiotic, nitrofuran, was detected in shrimp coming to the EU from Thailand, Vietnam, Indonesia and Bangladesh. The EU has 'zero tolerance' for these antibiotics. In addition, the EU destroys the products tested positive at the port of entry with no avenue for appeal by the exporters. For a short while, the EU imposed a 100% inspection on shrimp arriving from the identified countries (Keithly 2003). The US also has 'zero tolerance' for these two antibiotics. However, the USFDA methodology to test for these substances can detect only to 5 parts per billion while the EU can test to 3 parts per billion. This may have caused a shift of products from the EU to other markets.

2.2.3 Japan

The reputation of the Japanese for strict product guidelines and standards and for safety and quality is well documented. In fact, the Japanese consumer is more demanding of quality than the US consumer. For example, some shrimp supplies from India rejected by the Japanese because of a moldy smell are redirected to the US market, because the US consumer is not as sensitive to the smell (Jonker, Ito and Fujishima 2003). More detail on the Japanese guidelines are available in other documents (Henson and Mitullah 2003).

3.0 NICARAGUA SHRIMP SUBSECTOR

3.1 Legal and Regulatory Context

3.1.1 Government

Six different government agencies in Nicaragua participate in the regulation of the shrimp industry (Table 1). Three of these agencies are the most important and are discussed in more detail. The laws that assign various responsibilities to the government ministries were revised and passed in 1998. An old law, the Animal Health Law, was also revised in 1998, making the current food safety and quality laws in effect since 1998. It is clear that some of the pressure for law change came from both industry inside Nicaragua and the government to ensure that Nicaragua would retain its current status as an accepted shrimp exporter to major markets, particularly the US.

3.1.1.1 Ministry of Industry and Commerce-The Ministerio de Fomento Industria y Comercio (MIFIC) provides the following: a) supports policies relating to the rational use of sustainable extractive fishing resources and shrimp farming; b) application and monitoring technical regulations about the practices of fishing and shrimping, as well as security and protection with the Ministries of the Environment and of the Natural Resources, and of Labor and of Health; c) supports, revises, qualifies and informs applications for fish exploitation; d) supervises the activities and the execution of the obligations of the concessionaire and other users of the resource; e) authorizes the establishment of processing plants; f) applies the sanctions specified by law; g) participates in coordination with the Ministry of the Environment and Natural Resources in evaluating environmental impacts; h) initiates and implements programs of fishing development.

MIFIC authority can significantly influence the economic development and viability of commercial seafood production and processing in Nicaragua. MIFIC can issue or revoke licenses to harvest aquaculture and process seafood, including shrimp, relative to laws established to protect the resources and related environmental conditions. MIFIC can collect fees based on actual seafood production to support their respective activities. Likewise, MIFIC efforts are linked to additional mandates addressing related labor, social and communal issues. Recently, they supported Nicaragua's commitment to the eight key points in the Central America Free Trade Agreement (CAFTA) program which includes specific commitments for the welfare of labor which is monitored by the Ministry of Labor (MITRAB). This commitment distinguishes Nicaragua from other Central American nations and places Nicaragua on a higher scale for its products to nations that place a major priority on work conditions and health and welfare policies (Christian Martinez, personal communication). From another perspective, this may add cost to exports and make Nicaragua less competitive.

Table 1.--List of certain government organizations in Nicaragua that have authority over shrimp production, processing and exporting.

Government Program	Shrimp related Authority*	Related Taxation*
Ministry of the Environment & Natural Resources (MARENA)	issues permits for shrimp farm construction	not evident through interviews
Ministry of Industry and Commerce (MIFIC)	registering and licensing of processing operations; certificates for export development; and promotion program through National Administration of Fishing & Aquaculture (AdPESCA); plus monitor larval transport in country (AdPESCA) and in export (CETREX)	any fees for registering and licensing; export certificate fees through Center of Process of Exports (CETREX); registration fee through General Administration of Natural Resources (DGRRN); fees per hectare used for farming via AdPESCA; fees for operation of larval labs
Ministry of Agriculture & Forestry Areas (MAGFOR)	all aspects of food safety, HACCP and sanitation through processing; cooperates with MIFIC in registration and issuing certificates for export approval	monthly processor fee for services tax per goods and property HACCP certification fees
Ministry of Welfare (MINSA)	provides operational licenses for personnel hygiene and sanitary concerns	not evident through interviews
Ministry of Labour (MITRAB)	monitors requirements for laborers including wages and conditions	can impose legal fines for lack of compliance
Ministry of Transport & Infrastructure (MTI)	vessel registration	registration fee per vessel size

* The listings are not inclusive and include only those that pertain to shrimp.

Although MIFIC has diverse and comprehensive authority, implementation can be questioned. Naturally, commercial interests resist production-based fees, particularly for activities that do not provide more obvious benefits. Common complaints include concerns for the limited activities and benefits of MIFIC's technical fishery development program, AdPESCA. Likewise, certain attempts for fishery management are considered restrictive for responsible participants while encouraging renegade or pirated commerce. For example, difficulty in the prevention of renegade or pirate elements that harvest and sell lobster products either out-of-season or by illegal

size could harm the reputation of the entire industry. This illegal practice could devalue the export businesses and the ability for governance of other related seafood production and safety issues. Part of this is due to limited resources for regulation and the remoteness of the lobster fishery on the remote Caribbean coast.

3.1.1.2 Ministry of the Environment and Natural Resources-The Ministerio del Ambiente y los Recursos Naturales (MARENA) is responsible for the following functions: a) formulates, proposes and directs national policies of the environment in coordination with the respective sector Ministries regarding the sustainable use of natural resources; b) formulates regulations of environmental quality and supervises their execution and administers the System of Environmental Impact Evaluation regarding the plans and programs of municipal and sector development; c) controls pollution and supervises the national registration of chemical or physical substances that affect or damage the environment; d) administers the system of protected areas of the country and their surrounding areas, with their respective areas of reduction and formulates and proposes strategies, policies and regulations and creates and monitors them; e) formulates, proposes and directs the laws and regulation of the sustainable use of the natural resources and their monitoring, including quality control and appropriate use of the natural resources; f) coordinates with the Ministry of Industry and Commerce (MIFIC) regarding sector planning and the policies of sustainable use of natural resources, including mining quarries, hydrocarbons and geothermal, state lands and forests, fishing resources and aquaculture and waters.

3.1.1.3 Ministry of Agriculture and Forestry-The Ministerio Agropecuario y Forestal (MAGFOR) is responsible for the following functions: a) formulates and directs the plans of animal and vegetable sanitation and administers the quarantine system, administers and supervises the National Registration of Pesticides, Toxic, Dangerous Substances and other similar substances; administers Law No.274, 'Basic Law for the Regulation and Control of Pesticides, Toxic, Dangerous Substances and other Similar Substances;' b) formulates proposals and coordinates with the Ministry of the Environment and Natural Resources the programs that protect the ecological systems, with emphasis on the conservation of soils and their discharges; c) formulates and proposes the delimitation of areas and limits of agricultural, forest development, agro forestry, aquaculture and fishing, in coordination with the Ministry of the Environment and Natural Resources; d) issues the phytosanitary permits that are necessary to fulfill the contracted obligations by virtue of acquired commitments at the international level or based on the law.

3.1.2 Fiscal

Productive activities dedicated principally for export, such as shrimp processing, are subject to a series of legal instruments that define the fiscal incentives for participating in the export industry. In general terms those producing shrimp are entitled to: a) exemptions from taxes and rights that burden the importation of necessary machinery for production, inventories of necessary machinery, raw materials, semi-manufactured articles, inputs and packing materials or containers used for the products to be exported; b) exemptions from the General Sales Tax for the purchases of inputs or materials that are purchased for use in the production of items that are to be exported; c) access to foreign currencies generated by the exports, and the allowed use of them in the payment for imports according to the regulations of the Central Bank; d) reimbursement of 1.5% of the value (FOB) of exports[11]; e) suspension and refund of the Specific Tax of Consumption (IEC) for equivalent fuels at US$0.07 per exported pound.

[11] Nicaragua taxes exports at the rate of 1.5% of the value of the goods. This has the effect of limiting economic growth within Nicaragua. In addition, Nicaragua exporters indicated it was very difficult to actually get the reimbursement. Normally it takes legal representation and the reimbursement is 'bargained' as a credit against future taxes.

3.1.3 Legal

The regulatory agency for fisheries in Nicaragua is the Ministry of Industry and Commerce (MIFIC). Within MIFIC, the National Fisheries and Aquaculture Administration (AdPESCA) has jurisdiction throughout Nicaragua and its territorial seas. Access to salt flats for shrimp culture is through land concessions as extended by MIFIC through the Director of Natural Resources. Thirty-year terms are available which are renewable for the same time period. The annual lease is equivalent to US$30.00 per hectare. The Nicaragua Legislative assembly is currently considering two proposals. One would create a system of public land for aquaculture at the set price of US$30.00 per hectare per year and the other is to evaluate the current annual fee of US$30.00 per hectare.

Another issue is that the legal standing of shrimp farmers is unclear. There is no formal legislation related to shrimp farming or aquaculture on a congressional level. The General Law of Fisheries and Aquaculture had been approved generally in the National General Assembly, but has not been approved in all its line items. This makes the legal status of shrimp farming subject to administrative and ministerial decrees as opposed to laws of a more formal nature (Saborío 2002).

3.1.4 Environmental

A study of the Estero Real area currently recommends environmental standards and ways to promote investment in the area. Measures under consideration relate to the prohibition of intensive culture systems, introduction of exotic species, cutting standards for mangroves and the use of chemicals that affect the environment among others. Estuaries for intake and drainage are determined in the contracts of each concessionaire to avoid contamination between neighboring farms and to assure the sustainable development of aquaculture. A 1996 Law of Environment and Natural Resources mandates an environmental impact study that must be approved by the Environment Ministry (MARENA) prior to the construction of a shrimp farm. Another law, The Basic Law for Regulation and Control of Pesticides, Dangerous Toxic Substances and Others, regulates the use of controlled substances in the environment (Saborío 2002).

3.1.5 Investment Incentives

Incentives for foreign investment are outlined in the Law of Foreign Investment that guarantees the free repatriation of capital and profits and establishes arbitration, local and international, to protect the rights of interested parties. Foreign investors may shelter their investment by registering with the Central Bank and signing a contract of Foreign Investment with the Ministry of Economy that sets the obligations and rights of both parties (Saborío 2002).

The development of shrimp culture requires large credit resources from the Nicaragua financial system for operating as well as related ventures. However, within Nicaragua, the availability of both long-term and operating capital has limitations. Fiscal standards of the Superintendent of Banks require that a financial institution cannot risk more than 15% of its capital on any one venture. Commercial banks have stretched their available capital for shrimp farming very close to the permitted limit (between US$3.0 and US$6.0 million) due to their total capital assets availability. Long-term financial investment programs at favorable interest rates do not exist; those that do are earmarked by the government for the agriculture sector, with emphasis on small and medium-sized producers. Bank creditors insist that producers present real guarantees worth at least 150% of the value of the loan, as well as provide 20% of the total

investment. The bank does not accept the land concession as a guarantee, nor does it accept as guarantee the projected value of the harvest (Saborío 2002).

3.2 Production

3.2.1 Caught Shrimp

The shrimp trawling fleet registered to harvest in Nicaragua contains 93 vessels (Table 2). The Pacific Coast fleet contains 20 vessels with 11 owned by citizens of El Salvador and 9 owned by Nicaraguans. The Caribbean Coast fleet numbers 73 with 43 owned by US interests, 11 by Koreans and 19 by Nicaraguans. Hence, the total fleet of 93 vessels presents the following ownership patterns: El Salvador, 12%; Korea, 12%; Nicaragua, 30%, US, 46%.

3.2.1.1 Pacific Coastal Shrimp-This resource is distributed along the Pacific coast. The main species subject to exploitation are white shrimp, red shrimp, brown shrimp, tiny shrimp and the tiger shrimp (see Table 3). Distribution, depending on the species, ranges from shallow coastal waters to about 270 feet, depending on the bottom topography and texture. Most of the shrimp are caught by large trawlers, although some are caught by hand fishing in the Gulf of Fonseca and in natural lagoons in the Estero Real. The coastal Pacific fleet produces less than the coastal Caribbean fleet. Since 1989, Pacific coastal production has ranged from 1.723 million pounds to 327 thousand pounds (Appendix Table 2). The white shrimp, *Penaeus vannamei*, is the principal species for cultivation. Since 1992, a hand fishery has produced post larvae white shrimp to sell to the shrimp farms located near the Pacific coast as wild seed to stock the ponds. Another small shrimp fishery for the nylon shrimp or camel (Heterocarpus spp.) is pursued in waters over 600 feet. Since 1993, from one to three deepwater trawlers per year have participated in the fishery with the highly variable catch reaching its peak at 346 thousand pounds in 1994.

3.2.1.2 Caribbean Coastal Shrimp-Principal species caught on the Caribbean coast are red shrimp, white shrimp, rosy shrimp, brown shrimp and the tiny shrimp (Table 4). They are distributed along the entire Caribbean coastal shelf and the interior lagoons. Both national and foreign flag trawlers and a growing number of hand fishermen produce the catch. Between 1989 and 2002, catch has ranged from a low of 1.430 million pounds in 1992 to a high of 4.541 million pounds in 1995 (Appendix Table 3). Shrimp farming does not occur on the Caribbean coast. Since 1989, the volume of shrimp caught along the Caribbean coast of Nicaragua has been 77% of the total caught shrimp for Nicaragua. Interviews were conducted with the owners or fleet managers representing 82 (88%) of the vessels registered to trawl for shrimp in Nicaragua. Management of the 11 Korean vessels on the remote Caribbean coast could not be contacted. The main problem affecting all the vessels in Nicaragua is the world-wide 20-year low in the price of shrimp. Trawling is fuel intensive and costs are high and the trawl fleet has fewer opportunities to control, and lower costs, than do other groups in the production sector.

No safety and quality problems over the last five years were reported by the fleet representatives. The Pacific vessels are freezer boats averaging 18 day trips. They have been operating since 1997 and have had no safety and quality problems. Each vessel has one of the crew members trained with knowledge about parts of the vessel that can cause cross-contamination of the shrimp. This person is trained by the fleet manager and files a report at the end of each trip. This fleet is experimenting with trawling for deep-water shrimp. The shrimp are co-packed by one of the Pacific coast processors.

Table 2.—Ownership of the shrimp vessel fleet registered to harvest in Nicaragua, June, 2003.

Ownership	Number of Vessels	Percent
Pacific Coast		
El Salvador (registered under Nicaraguan flag)	11	55
Nicaragua	9	45
	20	100
Caribbean Coast		
Korea (registered under Nicaraguan flag)	11	15
Nicaragua	19	26
USA	43	59
	73	100
Total		
El Salvador (registered under Nicaraguan flag)	11	12
Korea (registered under Nicaraguan flag)	11	12
Nicaragua	28	30
USA	43	46
	93	100

Source: Ministerio de Formento, Industria y Comercio, Dirección General de Recursos Naturales.

Table 3.—Shrimp species caught on the Pacific coast of Nicaragua.

Pacific Ocean	
Common Name	**Scientific Name**
White	*P. vannamei*
	P. stylirostris
	P. occidentales
Red	*P. Brevirostris*
Brown	*P. californiensis*
Titi	*Xiphopenaeus*
Yellow Titi	*Protrachypene precipua*
Tiger	*Trachypenaeus byrdii*

Table 4.—Shrimp species caught on the Caribbean coast of Nicaragua.

Caribbean Sea	
Common Name	**Scientific Name**
Red	*P. duorarum*
White	*P. schmitti*
Rosy	*P. brasiliensis*
Brown	*P. aztecus*
Seven Beards	*Xiphopenaeus kroyeri*

The Caribbean vessels are about half freezer boats and half ice boats. They have been trawling in Nicaragua for about 10 years. Only one container of shrimp over five years ago has been rejected due to cross-contamination problems with fish scales. The product is packed in the Caribbean plant, but when capacity of the plant is reached, the shrimp are transported to an up-river dock and then by road to the Pacific-side plants in Chinandega. The road is inferior, the trip takes 26-28 hours and sometimes results in weight loss for the product. Like the culture industry, the shrimp trawl fleet is an important job creator in remote regions of Nicaragua. One fleet owner estimated that about 500 direct and indirect jobs were created by the fleet operation, or 11.6 jobs per vessel. One concern of this fleet is the perceived gradual decline in the catch of white shrimp. Coastal lagoons are important in the life cycle of this shrimp and there is speculation that run-off from interior mining operations may be affecting the quality of the lagoons and thus the stock levels of the shrimp. The Korean fleet operating on the Caribbean coast is reported by others in the industry to harvest shrimp that is packed heads-on for the Korean, and to a lesser extent, the Japanese market. They are packed by the plant on the Caribbean coast so the seafood quality and safety issues for the product was captured through the information provided by the management of the packing plant.

3.2.2 Cultivated Shrimp

Nicaragua is considered by many to be the country having the largest potential for shrimp farming in Central America. This is due in part to the large area of wetlands, a suitable environment, and extensive network of rivers and two coasts. Despite this potential, shrimp farming has only become a key component of the seafood industry in Nicaragua during the last decade. In 1975, the Japanese government financed some research on ponds and floating cage culture (Jory 1998). In 1977 and 1978, two attempts at shrimp culture failed due to technical problems and the political climate. Artisanal fishermen near Puerto Morazán attempted estuarine enclosures with no success. During the early to mid-1980s, fishing cooperatives continued with failed farming attempts. These cooperatives finally achieved some commercial level production in 1987. With the support of INPESCA (the Government Fisheries Institute which later became AdPESCA), the number of shrimp farming areas and the total production area kept increasing (Jory 1998). In 1988, the Food and Agriculture Organization of the United Nations (FAO) funded a study that demonstrated the potential for shrimp farming in estuarine areas of the Pacific Coast (UN Food and Agriculture Organization 1988; Saborío 2002). Most of this area is located on the Estero Real/Gulf of Fonseca estuary system near Puerto Morazán in northwest Nicaragua.

Sustained commercial farming of shrimp began about 1994. This occurred due to the framework for a new market economy in Nicaragua and the success of shrimp farming on a worldwide basis that increased the interests of both national and foreign investors in shrimp farming. From 1994 to 1998, cultured shrimp exports from Nicaragua increased from 2.3 million pounds (US$7.3 million in value) to 8.9 million pounds (US$27.3 million in value)[12]. This demonstrated promise as a growth industry for Nicaragua. During this same period, the pond area under culture increased from 2,529 to 6,293 hectares. Culture practices also began changing from artesinal to semi-intensive. Average production nationwide also increased from 893 pounds to 1,405 pounds per hectare due to both increased production from existing farms and because of newer technology used in new farms. Investors began to request land concessions that in 2002 totaled 21,351 hectares on the Estero Real. Cooperatives have been extended 5,920 hectares and commercial enterprises have acquired 15,431 hectares, although not all the hectares are in actual

[12] Pounds and US$ are used in this section of the report rather than metric measures since the major Nicaragua shrimp export market is the US. The shrimp industry in Nicaragua records production and values in pounds and US$ although pond size is measured in hectares.

production. When Hurricane Mitch devastated the shrimp farming area in October, 1998, a total of 25% or 2,108 of the 8,299 hectares in production were destroyed. The infrastructure loss affected all systems, including large commercial farms as well as cooperatives (Saborío 2002). A particular problem for the cooperatives concerned financing. Prior to Mitch, the cooperatives had extended all of their assets to cover working capital loans. Both working capital and their concomitant loan guarantees were lost to the damage, and concern was created that the farmers would not be able to raise capital to remain in business, especially due to the already eroded confidence of the banks and other industries.

In 1999 the introduction of the White Spot Shrimp Virus (WSSV) caused large shrimp mortalities, with survival rates averaging near 15% (Saborío 2000). About 75% of the production area was affected. Measures were taken to better prepare the ponds and water, use certified post-larvae (virus free) and avoid water exchange during grow out. Despite these measures, the WSSV still causes problems in Nicaragua. Other disease problems have been associated with Taura Syndrome Virus (TSV), Necrotizing Hepatopancreatitis (NHP) and *Vibrio* bacteria. However, during the last three years, most of the skilled growers have learned how to minimize the damage from diseases by good management practices and appropriate testing of the shrimp and the water quality (Gary Cummings and Larry Drazba, personal communication). Their extensive efforts and costs in development and maintenance of the necessary disease controls is testimonial to the requirements that are essential in shrimp production in Nicaragua. Independent shrimp farmers may become more reliant on this expertise which should encourage more collaboration with the processors; otherwise, small independent farming could actual help propagate the disease problems.

Today, 9,351 hectares are in production. A total of 1,123 hectares are operated under rudimentary systems[13], 2,634 hectares are under extensive systems[14], 5,592 hectares are under semi-intensive[15] systems and two hectares are under closed zero water-exchange[16] systems. Cooperatives farm 3,619 hectares (38.7 %) of the total area in production and commercial private farms operate 5,732 hectares (61.3 %). The total area in production, 9,351 hectares, represents 43.8 % of the hectares that have been extended for production by the government (Saborío 2002). Thus, there is room for expanded production under currently permitted locations.

3.2.2.1 Cooperatives-Cooperative shrimp farm projects are socially organized involving members of the community in the area around the project. The cooperatives are organized under statutes and recognized by the General Bureau of Cooperatives of the Ministry of Labor. The

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[13] When abundant shrimp larvae are detected in surrounding areas, weir gates are opened to allow water to enter. The gates are closed and the shrimp grow to maturity based on the natural productivity of the water. Ponds range from a few hectares to hundreds of hectares.

[14] Built ponds usually 20 hectares or more are used and pumps are used to maintain water levels and manage salinity and oxygen levels. Yield depends on the natural productivity of the water which is maintained by inorganic fertilizer. Post larvae are harvested from the wild and the ponds are seeded at about 6-8 post larvae per square meter. During 2002 and 2003, several large growers have been successful in using both water exchange and zero water-exchange and modified management practices in both extensive and semi-intensive systems.

[15] The ponds are smaller, usually from 5-20 hectares. Post larvae are purchased from hatcheries and some producers use a nursery phase for post larvae. Seeding rates are 10-25 post larvae per square meter. Diet is complemented by feed and pumps are used to exchange water.

[16] These systems are highly technical and usually are only a few hectares with a small number of perhaps one-half hectare ponds. Pond water is treated and water outside the system is not used during the entire growing cycle. Ponds are plastic lined and aerators are used to control oxygen. Post larvae are seeded as high as 90-110 post larvae per square meter. The shrimp are fed throughout the entire growing cycle.

majority of cooperatives have organized into Unions and Federations. Currently there are about 151 shrimp farming cooperatives. Seventy-five have been extended concessions[17] and 76 are in the process of obtaining concessions. It is believed that other unregistered shrimp farm cooperatives also exist. The minimum number of members to create a cooperative in Nicaragua is 10, but there is no maximum number. The average number of members across the 75 cooperatives is 12 per cooperative. Most members are in fact a family. The average family size in rural areas in Nicaragua is six people. Thus, the 75 cooperatives involve 900 families and 5,400 people.

In 2000, there were five unions of cooperatives, consisting of 81 cooperatives. Thus, 54% of the all the cooperatives are registered with the Administración de Pesca y Acuicultura (AdPESCA) del Ministerio de Fomento de Industria y Comercio (MIFIC). Each union has a board of directors, composed of a president, vice president, secretary, treasurer, financial officer and board member. The same organizational structure is used in each cooperative and each has a legal representative and works committee. The number of cooperatives has declined, and in August, 2003, a total of 70 cooperatives remained and are organized into five unions:

The Regional Union of Shrimp Farming Cooperatives (URCOCAM)—8 cooperatives;
The Union of Aquaculture Practices Cooperatives (URCOOPRA)—6 cooperatives;
The Regional Union of Aquaculture and Subsistence Fisheries Cooperatives (URCOPANIC)—23 cooperatives;
The Regional Union of Western Cooperative Shrimp Farms (UNICAM)—30 cooperatives;
The Regional Union of Fisheries Cooperatives (URCOOP)—3 cooperatives

About fifty cooperatives are not affiliated with any Union; however, not all of these are in production.

Shrimp farm cooperative members are poor, with few resources. According to studies on shrimp farming carried out by PROGOLFO (Shrimp Research Center, Universidad Centroamericana 2000):

- Birth rates are high at 4.4%, with only 17% of the population older than 25;
- The unemployment rate is 50% and 36% of the population is classified as living in extreme poverty;
- The monthly average per capita salary ranges approximately from US$10 – US$22 per month, depending on the area;
- The population has increased much more rapidly than services in the Puerto Morazán municipality, the center of shrimp farming;
- There is no sewage system and traditional latrines are used with excrement deposited directly into the estuary;
- The municipality has no trash collection service;
- The level of schooling is 41%;
- Ninety percent of the population lives on the banks of the Estero Real.

[17] The Natural Resources of Nicaragua are owned by the government of Nicaragua. This ownership includes the right to conserve, develop and exploit the resources. The government can also contract with individuals or groups to exploit the resources (Article 102). Ministerial Decree 14-99 MIFIC establishes that shrimp farming can be conducted using natural resources through concession, which in effect is a contract with the government to use certain natural resources for the practice of shrimp farming.

At the beginning of the 1990s, the industry was dominated by artesinal practices. This was due primarily because of the economic ability of the owners (cooperatives). As more technical knowledge was gained and some financing programs became available, the cooperatives were able to improve their production infrastructure and learned better technical management skills. Most of these changes occurred in the cooperatives, in contrast to farms owned by operator and owners not in cooperatives. The latter installed mostly semi-intensive farms.

The sale and harvest of shrimp is their principal and usually only source of income. Before entering into shrimp farming, most cooperative members made a subsistence living fishing for finfish in the dry season and were dependent on shrimp in natural lagoons during the rainy season. This was supplemented by some agricultural work and household activities. Employment in the shrimp sector has allowed for an improvement in the quality of life, decreased basic food insecurities, increased access to education, health and entertainment, and provided more economic resources. Female participation in shrimp production operations for the cooperative sector is 26%; women especially are concentrated in labor associated with production operations, principally in larvae collection and, at harvest, in cleaning and deheading shrimp.

Of the total 7,154 hectares surveyed, only 35% are actively producing shrimp. This low production percentage is due to the lack of credit, and on many occasions, to losses suffered from natural disasters, such as Hurricane Mitch and production losses from disease. In 1994, rudimentary shrimp farming production was the most common. In 1995, the number of extensive systems began to increase, and dominated the industry for three consecutive years. This pattern was repeated with semi-intensive production systems as more hectares were put into semi-intensive production, so that semi-intensive culture is the most common since that time. A sharp increase occurred in the number of hectares in production by cooperatives when the change from extensive to semi-intensive methods occurred. Because of Hurricane Mitch, shrimp disease problems, low worldwide prices and high debts, the number of cooperatives in production is now declining. Of the cooperatives surveyed in the cited study:

- Only 57% have pumps in their production ponds;
- Only 30% of the cooperatives have any technical production equipment. The rest have no ability to control the ponds and must rely on natural consequences and remedial labor;
- 82% have constructed ponds (built for the purpose) with the remaining having some kind of natural or rudimentary enclosure;
- Only 65% of the cooperatives practice drying out ponds and only 52% disinfect the ponds;
- 41% percent of cooperatives carry out fertilization with inorganic fertilizers, the majority with urea and some with complete fertilizers;
- 51% feed the shrimp, and in the majority of cases, only in the last month of growth.

One hundred percent of the larvae used in cooperative shrimp production is wild caught (as opposed to hatchery purchased), and in all cases is purchased directly from larvae fishermen or larvae distributors. Only in some isolated cases and in special situations do cooperative members catch their own larvae:

- Only 41% of the cooperatives determine counts and species percentage for purchased larvae;
- Some cooperatives are beginning to analyze the larvae for stress. No cooperative has PCR testing done on the larvae which would help reduce disease problems;
- Water quality is analyzed by only 30% of those surveyed, and of these, 100% use their own equipment: oxygen meter, salinity meter and pH meter in a few cases;

- Samples are not sent to a laboratory for analysis or other tests; 36% say plankton analysis is carried out by their own biologists;
- Pathological analysis is usually not done, even when some symptom of infection is present. When infection is suspected, medicated feed is given in the majority of cases;
- 48% during the last five years have received direct technical assistance at the farm, paid for by themselves, and 6% have had donated technical assistance.

The actual number of cooperatives is declining due to a current restructuring on-going in the Nicaragua shrimp subsector. As discussed earlier, 81 cooperatives existed in 2000 and 70 cooperatives were in existence in August, 2003. As another example, one processor reported that the number of farm suppliers to the processing plant has declined as follows: 2001, 128 suppliers; 2002, 88 suppliers; 2003, anticipated 40 suppliers. The second cultured shrimp processor confirmed this trend. A supplier is defined as one person or 'entity,' i.e., small farmer that brings shrimp to the processing plant.

Needs and concerns expressed by the cooperatives in written surveys and during interviews[18] reflect typical and anticipated responses for most independent agricultural/aquaculture producers. When questioned about their experience with the most common seafood safety issues, they confuse production problems with food safety, but their list of issues did include the most pertinent food safety concerns probable for farmed shrimp (Table 5). The farmers are aware of concerns for seafood safety, but they do not consider these as primary issues. Their primary concerns and problems involve production.

Similar confusion is evident when discussing interactions with the processing operations. The farmers do not always understand the grading systems for shrimp quality that can influence the acceptance and value of their products. They dislike current requirements, imposed by the processors, to pay for analytical screening for bacteria and other potential contaminates. They

Table 5.--Concerns and actual problems involving production of shrimp as expressed by the shrimp farm cooperatives in Nicaragua

Seafood Safety Problems	Production & Quality Problems
Potential *Salmonella* contamination	Diseases that limit growth or kill shrimp
Proper use of sulfating agents to control blackspot	Poor or slow growth rates
Use of proper amounts of clean ice	Off-colors in shell or heads
Washing with clean water	Soft texture and thin shells
Proper handling and time-temperature abuses	Loose heads and broken shrimp

complain of little effort by the processors to explain the methods and needs for such grading and testing. However, many of them lack the education and skills to understand the scientific and analytical detail of the tests, and thus do not understand why one measure may result in a lower grade (and thus lower price) than another measure.

Their requests for assistance were dominated by unanimous and adamant pleas for financial assistance to support production. They indicated that there are no funds or loans available from government programs or regional banks, and previous private sources are rapidly

[18] Eleven small farmers representing all five unions and the union leaders were interviewed during a group meeting. Six had submitted survey responses prior to the meeting.

dwindling and becoming more restrictive. They requested longer term loans with longer periods for payments over years rather than the customary 4-6 months[19] which do not cover a sufficient period of production to allow reasonable time for performance relative to their productive seasons and related environmental issues. Lack of funds has significantly reduced the number of small, independent farming operations and could eliminate these operations in future Nicaraguan shrimp commerce. However, there have been both natural causes to create bad credit histories as well as problems due to the lack of management skills and in some cases dishonesty. The priority of needs expressed by the shrimp farmer cooperatives in support of independent shrimp farming in Nicaragua are as follows: (1) financial support; (2) longer term loans (over 3-5 years) with reasonable interest rates; (3) technical training and support to reduce or eliminate persistent disease problems; (4) training and explanations for shrimp grading for quality and analysis for product safety. The farmers did appreciate the benefits of additional education and training provided by various government and university programs in Nicaragua (i.e., UCA), but felt they were not being giving sufficient attention. They specifically complained about the lack of activity in certain support programs (i.e., AdPESCA) and requested continued and additional training and analytical help to monitor and prevent natural disease problems. At the same time, the agencies and training programs are frustrated with the cooperatives due to previous inability and performance in taking advantage of training, not complying with agreements to repay loans, and other points of conflict.

3.2.2.2 Commercial Farms-There are 153 shrimp farms having legal standing with MIFIC. Eighty-five of them are considered commercial[20] farms (not cooperatives), representing 87% of total farmed production in 2002. Thirteen percent of farmed production came from cooperatives. The commercial farms represent 51% of the total hectares in production. Of the total 85 farms, seven of them produced 50% of cultured production in 2002. The majority of the farms are Nicaraguan owned, yet four of the six largest are foreign-owned[21]. Three farms produce more than one million pounds per year. Three others produce from 500 thousand to one million pounds per year. Three of these six farms are owned by investors in the US (2) and El Salvador/Spain. Twelve others produce from 150 to 500 thousand pounds per year with five owned by investors in Nicaragua (4) and Panama.

The largest commercial farm is 840 hectares[22]. Nine farms are larger than 500 hectares and 11 are larger than 300 hectares. The 132 remaining are smaller than 300 hectares. While data do not exist to define the exact average size of the 132 farms, local estimates indicate that about 60 of them are on average 33 hectares and the remaining 72 average 147 hectares. Production methods vary from semi-intensive to intensive. Two of the farms operate with intensive methods by seeding at post larvae rates higher than 25 per square meter and they use aeration. The

[19] The growing cycle is about 110 days and working capital loans are given for the length of the cycle, often at 20-30% interest. Recently, farms with bad credit histories or no credit history reported borrowing working capital at 10-20% interest per month.

[20] Unlike cooperatives, there is no legal definition for a commercial farm in Nicaragua. Technically, both cooperatives and commercial farms are 'commercial.' That is, they are privately held enterprises growing shrimp for the market to make a profit. Locally, the term, 'commercial,' is used to describe the farms that are not cooperatives.

[21] A telephone survey was attempted in mid-August 2003, to determine ownership patterns of the largest 44 farms. Some of the owners could not be reached and others decline to disclose the nationality of the owners. Only six farm representatives would disclose the nationality of the owners. All farms are organized as Nicaragua companies but the owners may reside in other countries.

[22] This farm is the largest farm in contiguous hectares. Another indicated an expansion to about 1,300 hectares in mid-2003 by purchasing ponds that are in default with banks. These ponds are scattered and not in contiguous hectares.

remaining farms have ponds considerable size ponds and practice a minimum water exchange program in an attempt to avoid diseases.

As reported earlier, of the 160 known shrimp farms, 50 are currently operating under scrutiny for official sanitary requirements and MAGFOR has initiated a Good Aquaculture Practices program to encourage sanitary improvements for all shrimp farms. The 50 includes both commercial farms and cooperatives. Two of the six commercial producers of post-larval shrimp participate in the new GAP program. The primary hazards of concern are bacterial contamination (*Salmonella*) and the improper use of medications for treating the crop during grow-out. However, the final controls regarding HACCP rest with the processing sector. Two of the three largest farms are owned by the same investors and companies as the two processing plants on the Caribbean Coast. Thus, the safety and quality issues from the farmed crop are included with those of the processors in the following section.

The most significant technical problem facing shrimp farming is diseases such as Taura Syndrome and White Spot Shrimp Virus. Nicaragua does not have a complete laboratory to train personnel and needs to develop adequate infrastructure (Saborío, 2002). MAGFOR, the Nicaragua regulatory authority relies on CIDEA/UCA for support and must contract with CIDEA/UCA for more sophisticated laboratory analysis. CIDEA/UCA uses PCR equipment to test for White Spot Shrimp Virus, Yellow Head Virus, NHP and Taura Shrimp Syndrome. It also has a microbiological laboratory that conducts analysis for *Salmonella*, total coliforms, fecal coliforms, total bacterial count and resistance and sensitivity to antibiotics. CIDEA does require support to incorporate the analysis of antibiotic residues. The acquisition of HPLC-MS is needed and means for other bacterial analysis, such as the *e. coli* and *psuedemonas* is needed.

3.2.3 Processors

Nicaraguan seafood processing plants generated a finished production of 23,764 thousand pounds of fresh-frozen and fresh-iced product in 2002. Plants on the Caribbean coast processed 9,455 thousand pounds of principally shrimp tails and fresh-frozen lobster tails. Processing plants on the Pacific coast processed 14,309 thousand pounds with the main products farmed shrimp tails, fresh frozen heads-on shrimp, fresh-iced fish and the fresh-frozen caught shrimp tails. Processed and finished production from Caribbean plants increased 7% over 2001 production. This was due mainly to an increase in the shrimp tails (11% increase) and frozen lobsters (14% increase). Pacific plants increased 6% due mainly to the production of whole iced fish (42% increase), farmed shrimp tails (2% increase) and frozen integers (65% increase).

Installed capacity of the seafood processing plants in Nicaragua is mostly focused on shrimp tails, fresh-frozen lobster and some fresh-iced fish. In 1999, Nicaragua freezing capacity was 417 thousand pounds per 24 hours and 531 metric tons of ice production per 24 hours. In 2002, the freezing capacity was 532 thousand pounds per 24 hours and 624 metric tons of ice production per 24 hours (Appendix Table 4).

Sixteen processing plants of highly varied processing capacity and standards exist in 2003. Eight are along the Caribbean coast with seven operating. All eight along the Pacific coast are in operation (Table 6).

Table 6.—Seafood processing plants in Nicaragua, 2003.

Caribbean Coast	Pacific Coast
Puerto Cabezas	**Chinandega**
PROMARNIC	CAMANICA*
MARAZUL	SAHLMAN*
SAN MIGUEL	**Carazo/ Casares**
CARODI SEAFOOD	LANVINIC (San Gabriel)
Corn Island	**Managua**
PASENIC	NICANOR
CAF**	NICAFISH
Bluefields	EXPOMAR
OCEANIC	NEPTUNO
PESCA FRESCA	**San Juan del Sur**
	PAPAGAYO S.A.

*These plants process principally farmed shrimp with some vessel caught shrimp from the Pacific coast and in high catch years some vessel shrimp from the Caribbean coast. The ownership of both plants is US.

**This plant focuses on lobster processing but uses available capacity to process shrimp vessel shrimp from the Caribbean coast. The ownership is Nicaraguan.

Only three of the 15 operating seafood processing plants are processing shrimp[23]. One was originally established to process spiny lobster and is located on remote Corn Island off the Caribbean coast. Spiny lobster is still the principal product of interest, but shrimp from the Caribbean trawl fleet is processed during the time lobsters are not in season and during slack time. Shrimp are trucked to the plants on the Pacific coast when spiny lobster processing fills the plant capacity. The two plants in Chinandega near the Pacific coast were established to process the shrimp coming from the shrimp farms around the Estero Real.

The Corn Island plant was built in 1992, originally by Norwegian investors and was acquired by the current owners in 1993. One plant in Chinandega was built in 1994 and acquired by the current owners in 2000. The second Chinandega plant was built in 1998 by its current owners. The owners of one Chinandega plant have another shrimp processing plant in Guyana. The other two owners have no other plants. Average employment for the three plants is 147 full-time employees (range is 72-250) and 406 part-time employees (range is 242-500). Both Chinandega plants process 100% shrimp while the Corn Island plant processes 42% shrimp and 58% spiny lobster. The Chinandega plants are owned by US investors while the Corn Island plant is Nicaraguan owned.

The processing capacity averages 28 metric tons per day (range 10-40). Since 1995, the Chinandega plants have operated at 20% capacity and the Corn Island plant at 95% capacity. During 2002, the Chinandega plants operated at 20% and 25% capacity and the Corn Island plant at 100% capacity. Capacity at 100% (if plant operated 24/7 year-round) is not achieved due to the seasonal growing cycle of the farms (two cycles per year with down time for pond preparation

[23] The information contained in this and other sections on safety and quality is based on surveys completed by individuals in Nicaragua government agencies and companies involved in shrimp trawling, farming, processing and exporting in Nicaragua. All the surveys were provided to respondents during early August, 2003. They were completed and submitted to the research team prior to a personal visit or obtained during the personal visit. Each survey was discussed in detail with the respondents during the interviews which occurred in mid-August, 2003.

and to grow during warmer months) and in some cases because the cooperatives have declined in number. However, the cooperatives provide a small percentage of the total raw product to the plants for processing. Excess capacity does exist to process more shrimp. Both Chinandega plants also own a large hectarage of their own ponds and pack for other large farms. For one plant, the top three suppliers (including its own ponds) provided 58% of the shrimp for packing. The next seven farms provided 26% of the shrimp. The remaining 16% of the shrimp came from 78 farmers (cooperatives). However, both plants desire to work with the cooperatives to ensure jobs and economic growth in the community, and because many members of the same families are employed by the processing plants.

All three plants pack peeled frozen shrimp. The Chinandega plants also pack frozen heads-on, frozen heads-off, peeled and deveined tail-on, peeled and deveined tail-off, peeled and pulled vein, butterflied and individually quick frozen. One plant is experimenting with frozen bait shrimp for the US recreational fishing market. Peeled frozen product has increased in all three plants since 1995. One plant is processing fewer heads-on shrimp and one is processing more. Two are processing more value-added products and one is producing the same amount since 1995. Examples of newer value-added products are peeled pulled veins, bait shrimp and a deepwater shrimp from the Pacific coast. All processors want to increase the amount of value-added products in response to market demand, concurrent improvements they have made in sanitation procedures and processing capability and in the exploration of alternative species to supplement production.

There has been some change in sources of shrimp during the last five years. The number of cooperative suppliers has declined and the plants are trying different management models to reduce risk and still maintain business relationships with the cooperatives. One plant has terminated investments in cooperatives while two plants are increasing the numbers of hectares of self-owned ponds to ensure steady supplies and to become more vertically integrated, and one is exploring the processing of deepwater shrimp. The source of shrimp is as follows for the two Chinandega plants: own ponds (28%, range 25-30%); cooperatives (13%, range 10-15%); trawlers (10%, range 0-20%); co-pack (50%, range 40-60%). The Corn Island plant receives 5% from trawlers and co-packs 95%. All three plants receive 100% of their product from Nicaragua ocean or pond sources. One hundred percent of all shrimp processed in the three plants is exported.

3.2.4 Potential for Value-Added Products

All shrimp processors in Nicaragua indicated interest in increasing their current line of value-added products. The incentive is to increase returns on regional product value, maximize utilization of processing operations and remain competitive in their established international markets. Value-added products also offer entry to alternative and additional markets in existing and new nations for export. Current market trends are demanding more ready-to-eat, ready-to-cook, and case-ready retail items to suit consumer appeal and convenience. This trend is also driven by efforts to purchase products that do not require additional handling or preparation in retail and restaurant operations of nations with higher labor costs. For example, a case-ready product pre-packaged and pre-labeled to suit a particular retail supermarket could be simply displayed frozen or thawed during display without any further product packaging or preparation. A pre-stuffed or pre-marinated shrimp on an attractive platter or skewer could be ready-to-cook at home or in a restaurant either in the original packaging or from the frozen state. Such products are ideal for the shrimp processor with cultured shrimp that provide uniform products that suit ready-to-order portions and packaging. Likewise, lower labor costs in Nicaragua offer cost advantages

for product assembling prior to export. The current processing operations have existing equipment and expertise to participate in this market trend. Needs for specialized equipment do not pose financial constraints for such ventures, but additional training, product assessments (quality, safety and acceptance) and market advice are necessary to participate.

3.2.5 Major Challenges

Necessary assistance to meet the prevailing challenges can be grouped into four categories: production problems, industry structure and industry distinction.

3.2.5.1 Production Problems-In addition to product quality and safety, the volume and consistency of shrimp production in Nicaragua is a challenge to the competitive position in international markets. Other sections of this report address the specific constraints and needs to assure and increase farmed harvest for larger supplies and more predictable production. A larger more dependable supply will enhance the exporter's ability to secure more long-term accounts from more dependable and reoccurring buyers. Current production trends in Nicaragua suggest the major aquaculture shrimp exporting firms could offer exclusive arrangements for single buyers seeking more reliance and control of their supply and products from more fully integrated operations that provide traceability and more confidence for product quality and safety.

3.2.5.2 Industry Structure-In Nicaragua, the initial reliance on small farm production is shifting to a higher percentage of large farm production that allows integration of the appropriate controls for product quality and safety. This trend also suits international expectations that are increasing demands for product control and traceability from the initial point of production through processing to final distribution. Product identity is the new addendum to HACCP that is being mandated by both regulatory agencies and buyers. This situation combined with the risks associated with small farm operations is dictating a change in the structure for shrimp production around the world.

Continued shrimp production by small, independent farms is pressured by decreasing product value, needs to implement more involved production techniques, and limited availability of loans. Smaller farms will need to become more closely integrated with the processing operations to survive. Without appropriate controls that can likewise, be evidenced through product traceability that involves recorded performance and analytical scrutiny, small farm products could be considered a liability in international commerce. The desire for independent production and the need for communal participation in the shrimp industry are understandable and necessary, but this situation must be more integrated with a commercial entity that offers the necessary controls and evidence that the resulting products were produced in a safe manner to suit international expectations and a cost-effective way to maintain economic viability. Small farms cannot rely solely on the government programs in Nicaragua to fulfill the international expectations for safety, quality and competitive prices.

3.2.5.3 Industry Distinction-Product quality and safety of Nicaragua shrimp is not readily evident to most seafood buyers and regulatory programs in other nations. Likewise, the relatively small volume of production limits commercial competition in larger markets that depend on more sizable and reliable production through all seasons. To be more competitive and assure the highest value from Nicaragua shrimp resources, the industry must become more distinct. Commercial efforts must distinguish themselves and Nicaragua shrimp relative to unique

attributes (product safety and quality), new value-added options and 'youth'[24]. Youth implies the commercial production of shrimp in Nicaragua is relatively new in comparison with more established production in other popular regions for shrimp production. The youth and smaller-sized production can be portrayed as more controllable and more responsive to the environmental concerns and local communities than occurs and continues in the more established regions. Commitment to environments and community are features influencing international commerce, and the smaller production size with full integration caters to single buyers seeking more control and knowledge of their products. Food safety will be a necessary part of this distinction.

3.3 Technical Assistance to Date

Since 1994, 18 different institutions, organizations, programs and universities have provided training to the shrimp cooperatives. The majority of this training occurred from 1994 to 1997. The number of training programs decreased after 1997, leaving only CIDEA/UCA to provide training in 2000. Cooperatives were surveyed during 1999 (Shrimp Research Center, Universidad Centroamericana 2000). During the five years prior to the survey, it was reported that four government institutions supported training: AdPESCA (23%), MARENA (4%), MAGFOR (1%) and INATEC (18%). Training was also reported given by international donor agencies: PRADEPESCA (EC) (9.5%); China Mission (1%); PROGOLFO (13%) and DANIDA (6%). Various NGOs and civic organizations also added to the effort: TRABANIC (2%); FENIPESCA (14%) and URCOOCAM (10%). Four percent mention receiving training from a private shrimp processor and buyer, Central American Fisheries (CAF). Of the total surveyed, 43% report receiving training from the University CentroAmericana (CIDEA/UCA). Additional intensive training began again as provided by CIDEA/UCA and the USAID/NOAA Hurricane Mitch Reconstruction Project (Shrimp Research Center, Universidad Centroamericana 2000).

3.3.1 Center for Shrimp Research (CIDEA/UCA)

When the shrimp farming industry began in Nicaragua, there was no training center for aquaculture. Nicaragua's national universities have responded by offering training to professionals as well as to producers. The University of Central America (Universidad Centroamericana/UCA) included this subject in its agriculture program and was later joined by the University of Mobile (Alabama, US) and the Nicaragua National Autonomous University of Leon (UNAN, Leon) joined in the effort to offer coursework in aquaculture.

UCA is also beginning to offer a degree program in aquaculture systems, and has a Research Center for Aquatic Ecosystems (CIDEA/UCA), which was begun with funding from the Cooperative Agency of Japan (JICA). This center is located on the central campus in Managua and has a laboratory for water analysis, a plankton analysis laboratory, microbiological laboratory, molecular laboratory, histology laboratory and bromatology. A PCR for detection of White Spot virus is in place, and the center also has a feed laboratory to carry out research in nutrition and prepare feed on a small scale. There is also a wet lab for thesis research.

Besides offering technical assistance to cooperatives, the center offers research and formal and informal training to the aquaculture industry. The Center also offers laboratory services to aquaculture producers. Through an inter-institutional agreement of ADPESCA/UCA-CIDEA, the CIDEA has a research farm located in Puerto Morazán to carry out research and training projects for students and cooperative members (Saborío 2002).

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[24] Vessel trawling has been on-going for some time in Nicaragua. However, about one-half the current production is now farmed with the start-up about ten years ago.

While CIDEA has been successful, some lessons learned since 1994 might be helpful to others if similar centers are planned for developing countries:

- CIDEA was created in 1994 with a limited vision and focused solely on shrimp. It should have been based on a strategic plan that included a complete vision of the aquatic industry and its interaction with aquatic ecosystems and public policy. It was only in mid-2003 that the Nicaragua government published the first national development plan in which shrimp culture was listed as a priority cluster.
- The initial narrow vision was due to the fact that the center was promoted by the Japanese Cooperative that was focused on the development of basic shrimp research, due to the success of this industry at an international level and the great natural possibilities that Nicaragua had for shrimp farming development. Initially, the center was not designed to support the private sector or the development of joint research that would increase production for the farmed shrimp industry.
- The initial vision restricted the creation of a diverse group of projects and cooperative sources based on a strategic plan. The lack of long-term programs and resources resulted in specific and short-term research, without a strategic impact on the private sector, which has remained underdeveloped in relation to other Central American countries.
- Due to the lack of bank loans for the shrimp culture industry, the Japanese Cooperative included a fund to finance the cooperatives. This was administered by the center. It should have been initially assigned to a financial institution because it involved too much time and it created conflicts with the cooperatives.
- In order to contribute to the economic stability of the center, and to the improvement of shrimp production, services should have been offered to the private sector from the beginning. This should have included laboratory work, especially pathology. Even though there has been improvement in equipment and the ability to offer greater services to the private sector, the laboratory is working on obtaining certification and still needs important equipment.

3.3.2 Hurricane Mitch Small Shrimp Producer Assistance Program

At the request of the U.S. Agency for International Development (USAID), the US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) enlisted Michigan Sea Grant (University of Michigan), Florida Sea Grant (University of Florida), a private firm, Aquatic Designs, Inc., and Puerto Rico Sea Grant (University of Puerto Rico) in a project during 2001 to offer technical assistance in the rebuilding of the shrimp farming sector in Nicaragua after the devastation caused by Hurricane Mitch in October, 1998. The goal was to provide training and demonstrations on an intensive zero water-exchange shrimp culture system, improve economic viability and financial access to producers, increase national aquaculture professional and technical capabilities and create an on-going Extension capability in Nicaragua (Michigan Sea Grant College Program 2002).

3.3.2.1 Intensive Shrimp Culture Project-Michigan Sea Grant contracted with Florida Sea Grant and Aquatics Design, Inc., to build and operate a zero water-exchange intensive shrimp culture demonstration project at the UCA demonstration farm in Puerto Morazán. The goal was to demonstrate a system with the potential of producing shrimp with a higher level of bio security (eliminate WSSV), with reduced environmental impact and a higher economic return per hectare than semi-intensive methods. The results indicated that the system can be retro-fitted on a traditional semi-intensive farm, that it can create a higher water quality (reduce the WSSV), and that virus can be managed with trained labor and skilled management in place (sometimes a

problem in Nicaragua). There were problems with other diseases and the lower overall water quality in the area of the UCA farm.

The economic analysis compared the returns with traditional semi-intensive farms in the area. Even though the zero water-exchange system provided a small profit (US$0.10) difference per pound harvested when compared to semi-intensive systems, gross profit generated by the zero water-exchange system on a per hectare basis is significantly higher. Annual profit per seeded hectare for the zero water-exchange system was US$21,989, compared to US$1,532 for semi-intensive systems. A disadvantage is a much higher initial capital investment to build the system. The analysis was conducted at US$3.00 per pound of shrimp. Price for shrimp at the time was US$2.05 per pound, a 20 year low, which has persisted through early 2003. At the current price the system was not profitable and actual harvest levels were lower than projected.

Two workshops were held in Puerto Morazán in December, 2001, for farmers and bankers to present the results. A total of 34 people attended the workshops. They represented cooperatives (8), commercial farms (12), university/technical (6), banks (5) and affiliation not given (3). Complete details on this program are available (Lopez et al. 2002a; 2002b).

While this project was successful, it was not nearly as successful as it could have been because of the following reasons:

- The project had to be completed from start to finish in a 12 month period, based on USAID funding pressure. This included project design, construction and operation. The goal was to construct the project and grow two cycles of shrimp. Due to delays in construction and in getting equipment on site, only one crop was accomplished.
- The project should have been funded for at least three years. This would have allowed project construction and two years of trial growouts. UCA/CIDEA attempted growout in the second year but financing was inadequate. External funding over years two and three would have allowed the project to mature, more training of local labor and others to duplicate the project in other locations.
- Funding was also not adequate to keep trained labor and technicians at the site at all times. Labor and technical problems occurred because of this.
- The project was located at the CIDEA/UCA site near Puerto Morazán. This was not the best site due to available water quality and other reasons. However, this kept the project in the public domain and available to all to see, visit and learn from. Locating the project at a different site would have led to fewer virus problems and fewer water quality problems.

3.3.2.2 Safety and Quality Training-This project was led by Florida Sea Grant (University of Florida) with its extensive Hazard Analysis Critical Control Point (HACCP) and Sanitation training programs and materials. The goal was to provide education, training and practical experience for professionals in Nicaragua that support the shrimp and aquaculture industry through academic programs, regulation or commerce. Participants in the training program were selected based on recommendations of the Nicaragua shrimp industry, pertinent regulatory agencies and CIDEA/UCA. The 24 participants represented the following sectors: Nicaragua agency governing food safety and commerce (MAGFOR) (5); cooperatives/unions (5); commercial processors (11); CIDEA/UCA (3). Each participating location was provided various supplies (e.g., sanitation supplies and materials) as a lab-in-a-box to take back to their location.

The individuals received HACCP training as prepared by the internationally recognized 'Seafood HACCP Alliance' program which is certified by the Association of Food and Drug Officials (AFDO) of North America. A Sanitation Control Procedures training course was also

provided as a companion course to HACCP. It is recognized by the U.S. Food and Drug Administration. Finally, the five-day Latin America Shrimp School was conducted in Chinandega, near Puerto Morazán and the center of the shrimp farming industry. The school included lectures and hands-on training sessions. Trainers included representatives from the European Union, the U.S. Food and Drug Administration Office of Seafood and the University of Florida. Topics covered included HACCP, sanitation, regulations, decomposition, filth, sulfites/melanosis and microbiology (Michigan Sea Grant College Program 2002).

It is felt that the following benefits were provided to the Nicaragua government and private sector as a result of these workshops:

- All participants gained an awareness of the recognized procedures to prevent food safety illnesses. The training helped identify potential seafood borne illnesses.
- A greater appreciation was gained about the need for legislation and processor mandated controls, and the Nicaragua regulatory authorities are demonstrating a willingness to employ these controls.
- There is a higher motivation to use necessary controls in monitoring, there are fewer disagreements with processors and all parties are seeking greater knowledge.
- There is a willingness to produce safe food, not only for the benefit of consumers, but for the benefit of the next generation (children). On several occasions, the ability to produce safe products that would not make children sick was mentioned as a high priority. This was mentioned not only in the context of current health, but also in instilling in children the need for safe food which would be carried on into the next generation.

3.3.2.3 Extension-The Extension program was a joint collaboration of CIDEA/UCA and the University of Puerto Rico Sea Grant College Program. The goal was to implement an Extension coastal marine education and information and transfer program, develop a model for international Sea Grant Extension programming with a focus on coastal marine disaster mitigation with particular emphasis on shrimp farming and build local Extension capability by training three extension agents who would then work in Nicaragua through CIDEA/UCA. The program was designed to provide technical assistance to cooperatives, demonstrate new technology, provide formal training for small producers and the community in general and create a system and tools to provide environmental monitoring at the local level. Target audiences were the fisheries and aquaculture associations, government agencies and employees, union/cooperatives of small shrimp farmers, local schools and the community in general. The methods used included formal training, meetings with stakeholders, teaching at public schools and publicity through both print and media and radio.

From a meager beginning in Nicaragua in 1998 to create an Extension Program when three trainers (train-the-trainers) and 72 individuals were trained, the program with the new Hurricane Mitch program support in 2001 reached 38 trainers and 359 individuals. Trainers have been trained in Extension methods, HACCP, water quality, PCR, pathology and best management practices. Fifty-seven university students have been trained in primary production, pathology, water chemistry and nutrition, and 12 student interns have been trained in water quality, microbiology, PCR and plankton analysis. A total of 328 students from local schools have received training in water pollution and mangrove ecosystems. Other programs include an annual workshop for small shrimp farmers (in 4th year with 250 attendees), providing technical assistance to farmers in such areas as seed stocking rates and growth rate monitoring, providing trees for planting in Puerto Morazán where many shrimp farmers and workers live, a weekly radio program on such topics as pathology and methods to reduce pollution and providing aid to the local health center. Also in place at CIDEA/UCA are four new offices with computers and

equipment, audiovisual equipment such as a TV, VHS and digital camera, power generators and two vehicles (Saborío 2003). Two of the three Extension agents hired during the Hurricane Mitch project are still in place at CIDEA/UCA by university funding and thus the original investment continues to have an impact.

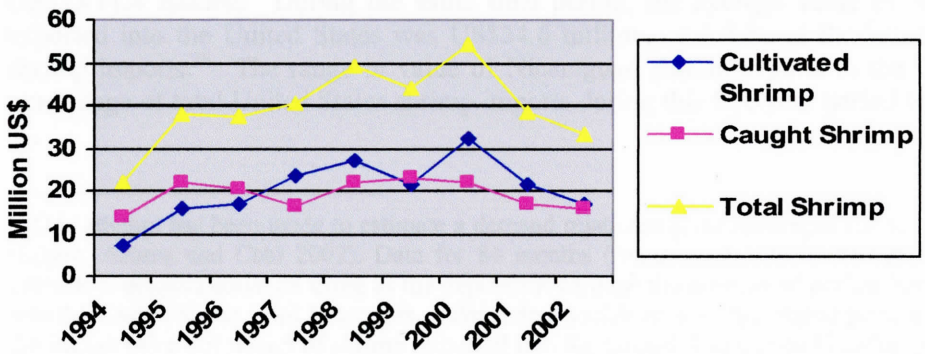
3.4 Shrimp Exports and Foreign Trade

The value of shrimp exports from Nicaragua increased steadily from 1994 to 2000 when the peak value of US$54.3 million was exported. Value exported in 2000 and 2001 was about equal to 1995 and 1996 levels[25]. The value of cultivated shrimp exports passed the value of caught shrimp exports in 1997 and has been slightly higher than caught shrimp every year since 1997 except for 1999 (Appendix Table 1 and Figure 6).

The volume of shrimp exports from Nicaragua peaked in 1998 at 14.8 million pounds. Since that time, annual exports have ranged from 11.6 to 13.2 million pounds (Appendix Table 5 and Figure 7). On a percentage basis, the volume of cultivated shrimp exported is even higher than the value percentage, when compared to caught shrimp[26]. Cultivated and caught shrimp together have represented from 46.4% to 62.7% of the volume of seafood exports from Nicaragua from 1994 to 2002.

The average value per pound of exported caught shrimp is normally higher since caught shrimp are a smaller count size (fewer shrimp per pound). Since 1994, the average value per pound of exported caught shrimp has been higher than the average value of cultivated shrimp in all but two years (Appendix Table 6). Shrimp size is the key determinant in setting price. For example, the average price of shrimp per pound imported from Nicaragua to the United States from 1994 to 2000 has ranged from US$2.74 per pound to US$5.18 per pound (Appendix Table 7).

Figure 6. Total value of shrimp exports from Nicaragua, 1994-2003



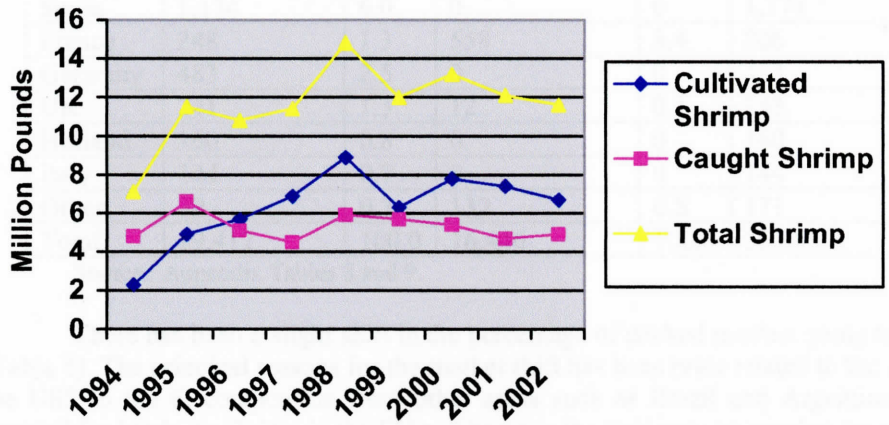
(Source: Appendix Table 1)

[25] This represented from 41.7% to 54.3% of the value of all seafood exports and from 5.6% to 8.6% of the value of all Nicaragua product exports from 1994 to 2002.

[26] Since 1996, when cultivated shrimp passed caught shrimp in volume exported, the percentage of cultivated shrimp in relation to the total volume of seafood exported has ranged from 29.1% to 37.7%. During this same period, caught shrimp has provided from 22.0% to 27.0% of the volume of seafood exports (Appendix Table 5 and Figure 7).

The US is the principal export market for Nicaraguan shrimp, accounting for over 87% of exports from 2001-2002 (Table 7). Japan was the next most important at 3.9% and Spain purchased 3.3%. Several other countries purchased smaller amounts. Spain is a stronger market for cultivated shrimp while the Japanese market took a larger percentage of caught shrimp. The US market took equal shares of cultivated and caught shrimp. Complete details on all countries to which Nicaragua exported shrimp from 1994 to 2002 are provided (Appendix Tables 8 and 9).

Figure 7. Volume of shrimp exported from Nicaragua, 1994-2002.



(Source: Appendix Table 5)

While the United States is the principal export market for Nicaraguan shrimp, the influence or impact of Nicaraguan shrimp in the United States is insignificant[27]. The average value of shrimp imports into the United States from all sources from 1999 to 2002 was US$3,411.4 million. During the same time period, the average value of Nicaraguan shrimp exported into the United States was US$34.6 million, or 1.0 % of the value of United States shrimp imports.[28] The range in value of Nicaraguan shrimp exports to the United States as a percentage of total United States shrimp imports during this five-year period was from 0.8 to 1.2 %.

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[27] One attempt has been made to estimate a demand relationship for Nicaragua shrimp in the United States (López, Adams and Cato 2002). Data for 84 months (January 1994 to December 2000) were used to estimate a demand equation using as the dependent variable the quantity of peeled/frozen shrimp imported into the United States from Nicaragua. Independent variables were the import price per pound of shrimp, the import price per pound of shrimp imported into the United States from Ecuador, per capita income in the United States and a number of dummy variables to test for seasonality differences. Ecuador is the leading source of shrimp exports to the United States from Central and South America, although Mexico and Venezuela are also exporters to the United States. Ecuador exports roughly ten times the amount of shrimp to the United States as does Nicaragua. While the model estimation did produce some statistical problems, the results indicated that as United States export price per pound increases, exports from Nicaragua decrease. As United States per capita income increases, exports from Nicaragua increase. A similar attempt to use the quantity of peeled/frozen shrimp imported into the United States from Ecuador and to determine any complementary or substitution effects between shrimp from Ecuador and Nicaragua was not successful due to estimation problems.

[28] Calculated from data in NOAA, NMFS, Foreign Trade Information, Fisheries Statistics and Economics Division.

Table 7. Two-year average value of shrimp exported from Nicaragua by principal country, 2001-2002.

Country	Cultivated		Caught		Total	
	US$ (Thousands)	%	US$ (Thousands)	%	US$ (Thousands)	%
United States	16,923	87.2	14,360	87.3	31,283	87.2
Japan	0	0.0	1,384	8.4	1,384	3.9
Spain	1,174	6.0	0	0	1,174	3.3
France	248	1.3	558	3.4	806	2.2
Germany	483	2.5	0	0	483	1.3
UK	241	1.3	12	0.1	253	0.7
Holland	160	0.8	0	0	160	0.4
Italy	144	0.7	0	0	144	0.4
Other	39	0.2	132	0.8	171	0.5
Total	19,412	100.0	16,446	100.0	35,858	100.0

Source: Appendix Tables 8 and 9.

There has been a slight shift in the percentage of packed product going to export markets (Table 8). The principal reasons for the market shift has been price related to the exchange rate of the US$ to the €, competition from other areas such as Brazil and Argentina, the decline in demand for heads-on shrimp in the EU and because the total volume coming from Nicaragua is so small that exporters are in a limited bargaining position. None of the market shift has been due to safety and quality problems. In addition, one plant took on partners with strong US markets.

3.5 Current Development Issues

Lack of infrastructure is a huge problem in Nicaragua. Problems with access to the shrimp farms become more significant each year due to bad roads. This limits access to existing farms and limits adding new farms in new areas. Product quality and safety are vulnerable. This is a particularly difficult problem during the rainy season in taking harvest to the processing plants or during the transport of raw materials to the ponds. Potable water systems and sewage systems do not exist in many towns around the Estero Real, the major shrimp farming area.

Table 8.—Market shifts for exports of Nicaragua shrimp exports by market in 2002 compared to five years ago.

Export Country	2002		Five Years Ago	
	Average	Range	Average	Range
	Percent			
United States	75	70-80	65	50-75
Spain*	8	0-15	20	0-40
France*	14	2-30	0	0
Japan	0	0	3	0-10
UK	1	0-3	0	0
Italy*	0.3	0-1	0.6	0-2
Germany*	2	0-5	0	0

*Member countries of the European Union.

Latrines are used that drain directly into the estuary without treatment. The waters become contaminated with bacteria or other microbiological contaminants. Continuation of these practices will create ever-increasing problems with water quality (Saborío 2002).

More attention must be paid to infrastructure requirements such as roads, docks, sewage/sanitary drains and potable water, etc. Additional needs relate to social requirements such as schools, health care, public housing and other issues. The work force in fishing, farming and processing must be healthy and productive for both economic and shrimp safety and quality reasons. The major area of shrimp culture around the Estero Real is one of the poorest in Nicaragua, and Nicaragua is one of the poorest countries in the America's. The development of aquaculture in the area has attracted a large population living in extreme conditions. While the processing plants and private investors rely on the population for labor and shrimp and do provide such needs as health care, the total social and overall economic needs are beyond the capabilities of the plants and investors.

3.6 Safety and Quality Issues

3.6.1 MAGFOR Authority

MAGFOR has proven beneficial for shrimp commerce in Nicaragua. The Administration of Animal Health, Department of Inspection and HACCP Certification has separate sections for meat, poultry, fish, aquatic products, milk and honey. The fish (Pesca) section covers fish and caught shrimp and the aquaculture (Sanidad Acuícola) section covers shrimp farms and post larvae laboratories. They test shrimp farms for veterinary drugs, medicated feeds and pesticide residues, etc. Processing plants pay a flat fee per month of 2000 Cordobas (about US$132) for the service. They are authorized to enforce requirements for Good Manufacturing Practices (GMP's), Hazard Analysis and Critical Control Point (HACCP), and sanitary standard operating procedures (SSOP) in accordance with specific and recently revised regulations that are current and appropriate as written. These laws are consistent with current international Sanitary and Phytosanitary requirements and methods, CODEX Alimentarius standards and related food safety requirements in nations receiving Nicaraguan exports. Their authority is primarily intended to assure the safety of seafood products for both national consumption and export. Their efforts through inspection of processing plants, shrimp farms and products are appropriate and current for the attributes of the seafood and aquaculture industry. They are aware of the pertinent food safety concerns and have analytical talent and instrumentation to monitor for potential problems and commercial compliance. They can collect actual samples for analysis from farms, during processing or prior to export.

Of the 160[29] known shrimp farms, 50 are currently operating under scrutiny for official sanitary requirements and MAGFOR has initiated a Good Aquaculture Practices (GAP) program to encourage sanitary improvements for all shrimp farms. Two of the six commercial producers of post-larval shrimp participate in the new GAP program. For processing firms, MAGFOR has pre-approval authority to scrutinize and approve a firm's HACCP program prior to implementation. They conduct random inspections of processing firms at least once every six months or in response to suspect operations. Likewise, they maintain a list of processing plants or

[29] Note minor discrepancy with earlier data indicating that 153 farms have legal standing with MIFIC. Eighty-five were reported to be commercial leaving 68 as cooperatives. Yet, the cooperatives claim to be 70 in number. This discrepancy is small and is caused by data from various agencies and sources and due to the rapidly changing restructuring of the shrimp subsector currently underway.

companies that are 'recognized' to export seafood. Placement on this list is based on pre-approvals for firms with current Hazard Analysis and Critical Control Point (HACCP) plans and related programs for sanitation. Currently 13 of the 15 licensed and operating seafood firms in Nicaragua, including all three shrimp processors, have proper HACCP plans and are approved for exporting. MAGFOR issues export certificates to acknowledge these firms prior to release of products. This activity distinguishes MAGFOR as the 'competent authority' with governance for seafood safety in Nicaragua.

3.6.2 Product Safety

Product safety of shrimp produced in Nicaragua has not been a significant issue based on actual incidences or regulatory consequences, but the shrimp products are vulnerable to contamination from natural conditions and lack of appropriate infrastructure to support product protection. The primary food hazards of concern are bacterial contamination (e.g., *Salmonella*) and chemical adulteration (e.g., improper use of medications). Both concerns involve shrimp production or farming activities. Appropriate and proven controls rest with the shrimp processing operations. As mandated by all major international regulatory programs, the seafood processor is responsible for implementation of controls and monitoring records to assure seafood safety.

Nicaraguan shrimp processors have well established and proven HACCP programs and related sanitation practices. HACCP is not an impediment to shrimp commerce in Nicaragua and lack of appropriate HACCP programs is no longer an allowable excuse. Regulatory and support programs (e.g., MAGFOR and UCA) need assistance to remain current both in terms of instrumentation and trained technical staff. Additional personnel and analytical capability, particularly as they relate to proper use of medications, are necessary for these essential programs to remain in a preventative mode rather than reacting to probable occurrences. The best technical investments would be to establish laboratory capability located and dedicated to shrimp farming and processing activities along the coast. These facilities should be provided with more rapid and convenient analytical screening methods that allow scrutiny of more samples prior to more involved confirmation testing at a more centralized facility within MAGFOR or UCA[30]. This investment is necessary to maintain the proven commitment to shrimp product safety, particularly as the industry diversifies into more value-added production.

Successful implementation of HACCP and the safety record for Nicaraguan shrimp production is not readily evident to other nations or buyers. Promotion support for both the industry and 'competent authority' needs to be packaged and staged to demonstrate the actual situation. A Nicaragua 'gold seal' program or similar label could distinguish the Nicaragua products and take advantage of the industry and regulatory investments to maintain product safety. This effort could be aligned with similar programs in other nations such as the voluntary inspection program for exports from the US as provided by the National Marine Fisheries Service, US Department of Commerce.

Concurrently, certain infrastructure must be improved in Nicaragua to help prevent particular food safety problems. The sources for potential bacterial contamination can be traced to improper waste disposal around farming areas. Prolonged transport due to inferior roads can contribute to time-temperature abuses that allow growth of potential bacterial contaminates as well as diminish the quality of the shrimp. Road construction and waste management require immediate attention and a continuous maintenance program in the region of shrimp production

[30] UCA currently has the capability to test samples at higher technical levels than MAGFOR, and is under contract with MAGFOR to provide some testing and analysis.

and processing. These developments would not only help protect the food products, but they can reduce production and processing costs to provide a more valuable and competitive product.

3.6.3 Third-Party Certification

As established markets become more dependent on aquaculture production which is expanding in more distant and remote regions, reliance on exiting regulatory programs to assure product quality and safety is being questioned. Original plans for more scrutiny through HACCP plans and identity of competent authorities in the respective producer nations were helpful, but they still require trust in recorded performance and the ability of the regulatory programs in nations often compromised by limited budgets. Likewise, the increasing workload on the authorities in the respective importing nations has stressed the existing import authorities beyond their ability to monitor a reasonable amount of suspect shipments. In the US, from 1998 through 1999, imported seafood products increased by 7%, while the proportion of foreign seafood entries detained for visual and/or laboratory examination decreased from 5% to 3%. Less than 1% of the imported seafood entries were subjected to the laboratory portion of the examination (US General Accounting Office 2001). The US Government Accounting Office is asking for more attention to imported seafood. Concurrently, new concerns for food security in response to terrorist threats have heightened concerns for food safety at points of entry into developed nations.

Private interests are responding with so-called 'certification' programs that will train and employ expertise to audit operations from the shrimp farm through processing to provide evidence for appropriate performance and food safety. The audits could also include laboratory verifications through site and product sampling and analysis. Most of these evolving programs are motivated by genuine concern for the industry, but they must depend on profit to attract expertise and maintain the services. Their source of funds will be based on fees–for–services provided by the different farms and processors. Government or other non-industry support is not apparent or probable. Similar non-government organizations (NGOs) exist and have struggled to attain recognition by the industry and the responsible regulatory authorities in both the nation of production and import. The future utility of NGO's to 'certify' seafood safety depends on buyer and regulatory recognition mindful of the programs capability, reliability and potential bias and graft.

One specific NGO for farm-raised shrimp is being developed with assistance from expertise in Nicaragua. This program, the Aquaculture Certification Council (ACC) grew out of the successful efforts of the Global Aquaculture Alliance to address protection of mangroves and other environmental concerns associated with shrimp farming. Their new plans are to address food safety and quality based on audits and potential sampling during farm and processing activities. Although these efforts are admirable in intent, their value will rest with regulatory recognition which is currently not evident. Nicaraguan farmers and processors should scrutinize these programs very carefully before engaging in contracts for services. The program intent and promotions may advocate buyer or import proprieties and preference, but assurances for such status have not been established.

Concurrently, the larger shrimp buyers are relying on their choice of internal audits contracted to scrutinize for their particular products and operating specifications. This approach is becoming routine for the buyers that recognize they cannot depend on regulatory programs to assure food safety. Likewise, most regulatory programs, particularly the USFDA, do not monitor nor specify attributes for product quality. This trend for more buyer scrutiny is another reason for more complete integration of shrimp farming and processing operations. The buyers will prefer to audit operations that have complete control of shrimp products from moment of production and

harvest through all steps of processing and export. The Nicaraguan shrimp industry could be better structured to anticipate this trend.

3.6.4 Current Status of Shrimp Safety

None of the three plants have suspended production since 1995 for reasons other than seasonality or normal down-time for maintenance. Rejected shrimp at the plant door from producers is not a problem. Rejections from their own ponds ranged from 0-0.5%; from the cooperatives, less than 1.0-0.4%, from the trawlers, 0-1.5% and from co-pack, less than 1%.

Changes that would improve the quality and safety of shrimp packed even more would be better roads from the pond to plant that would allow more rapid transport of the product. Product produced by the cooperatives would be safer and higher quality if iced more properly and with fewer time delays in delivering the product to the plant. A higher level of trust is also needed in the cooperative farmers that the shrimp are coming from the ponds indicated and that production methods are followed as prescribed by the plant. Trawl vessels in some cases could be maintained and upgraded to allow better handling of the product before in reaches the processing plant.

All three plants have made changes during the last five years to improve the safety and quality of the plants. Two have upgraded and expanded the plants including the general layout and chilling and freezing systems. All three have improved factory layout, laboratories for testing and analysis, the quality of water supplies, storage facilities, temperature controls, and tables and utensils. One has upgraded the ability to do IQF product and installed a chlorine in-line gas system. All three have increased the amount of training given to plant employees, including the supervisors and managers.

All three plants indicated buyers were more confident in their products since they implemented HACCP. HACCP did not lower the cost per pound of packed product and it did not lower overall marketing costs. Two plants felt that HACCP had the potential to reduce loss and detention of product but all three indicated that losses and detention of their products during the last five years had been minimal. Different buyers in different countries place a mixed priority on whether HACCP is in place or not. Some ask whether HACCP is being used in the plant prior to purchasing the shrimp while others asked only on occasion.

All three plants indicated that new employees had been added due to HACCP. Two indicated that one new quality control person had been added in each plant and one of the same plants indicated that one additional manager had been hired. One plant did not specify the number of employees. A significant number of quality control employees work at the plants. The average number of quality control managers averaged one (range 1-2); quality control supervisors averaged 14 (range 2-26); laboratory staff averaged three (range 2-4); one plant employed three samplers and another one manager and two supervisors specially assigned to HACCP procedures. One plant felt HACCP had improved their market competitiveness and another felt HACCP had not changed their competitive position.

All three processors have experienced negligible problems with rejected shipments at the borders of importing countries. Among the three companies, only four rejections have been reported since 1994. Two were into the US for *Salmonella*, one was into the US for filth (cross-contamination with fish scales) and one was into France because of improper labeling (lost in transit). It is now possible to check for import rejections using the Operational and Administrative System for Import Support (OASIS) Internet system of the US Food and Drug Administration. However, data are maintained for only the previous 12 months. From August 2002 to July 2003,

only four rejections from Nicaragua are listed: canned sardines, conch meat and frozen lobster tails (2). No import alerts are listed for the entire country of Nicaragua. These alerts go back for a number of years and have been developed to communicate guidance to USFDA field offices. The purpose of an Import Alert is to identify and disseminate import information (problems, safety and quality, trends, etc.) to USFDA personnel thus providing for more uniform and effective import coverage. Import Alerts identify problem commodities and/or shippers and provide guidance for import coverage.

Two processors felt US safety requirements were moderately strict and one felt they were somewhat strict. The exact same pattern was reported for Spanish requirements. One processor felt safety requirements for France were very strict and two felt they were moderately strict. The exporter to Japan indicated that safety requirements were very strict and the two exporters to UK felt that English requirements were very strict. It is important to note that the two processors have been certified by EU standards for importing into the EU. The exporter to Italy also indicated that standards were very strict as did the exporter to Germany.

The processors felt there was a need for convenient antibiotic tests for product screening and a standardized method for testing for antibiotics, that funds were needed for infrastructure support programs within Nicaragua, and that with proper controls the quality and safety of Nicaraguan shrimp would not be a problem.

There have been few problems with shrimp safety and quality issues in the Nicaragua shrimp industry. The culture industry is about a decade old. The two plants that do most of the processing and all the culture processing are relatively new. One was built in 1994, acquired by present owners in 1998, and upgraded. The second was built in 2000. They were able to install the latest technology in recent years. Both cultured shrimp processing plants, while incorporated as Nicaraguan companies, are US owned. They are operated by US managers and the major market is the US. One US owner has been in the shrimp business for at least 30 years and the other is one of the largest seafood importers/brokers in Florida. They have established solid reputations, and cannot afford to let a Nicaragua safety/quality problem damage their market reputation. Thus, they control the shrimp where it is processed and sell it in the market where they live and make all their money[31]. Although the industry has had virus and disease problems, they have not been as devastating on a country-wide basis like some of those in China and Ecuador, where some banned medications have been used. One processor indicated certain medications were not used because the risks of major market and reputation damage were too high if they were detected in samples, etc. They have learned to minimize disease effects in other

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[31]You can contrast this situation with the one in Bangladesh in the following way (Cato and Lima dos Santos 2000). The Bangladesh shrimp industry was in full process for years before the Nicaragua culture industry started. For example, 48% of the 120 seafood plants in Bangladesh (not all process shrimp---maybe 30 or so) had been remodeled prior to 1998 in order to meet minimum sanitary and quality standards. They were older plants, using older technology and many just used unsanitary processes. For example, some of the shrimp peeling sheds were open air, or under a roof with no walls. Contamination was widespread and a bad reputation was developed. The EU ban was necessary to force compliance with standards. Most of the Bangladesh plants are owned within country and they ship to major markets outside the country (Japan, US, EU). If a problem occurred in one market, they tried to shift to another. The owners were not in the markets where the shrimp were being shipped.

ways----lower stocking rates, water exchange policies and other techniques that at the same time have lowered per unit production costs.

3.6.5 Costs to Maintain Standards

3.6.5.1 Industry-All three plants have HACCP plans in place. They were implemented in 1997, 1998 and 1999, with the average time to implement 14 months (range 6-24 months). It was necessary to give additional training to all managers, supervisors and production staff in order to implement HACCP. Two plants did not record specific costs to implement HACCP during the time of implementation but did indicate when queried that additional costs were involved. They considered the improvements made to implement HACCP as part of their on-going safety and quality improvement programs. One firm did record specific costs. The first two provided information during personal interviews to supplement the specific costs obtained. It is estimated that the costs below reflect 'average' expenditures that are reasonable estimates for implementing upgraded safety and quality standards and HACCP in Nicaraguan shrimp processing plants and for maintaining the HACCP program. It is not implied that safety and quality standards were below minimum standards at the time of HACCP implementation. Rather, as technology and analytical techniques improve that allow the achievement of higher safety and quality standards, the plants implement them and may incur costs. They feel that these are not a 'cost to upgrade,' but normal costs incurred in integrate new technology into the processing plant. Thus, the cost estimates include normal business costs to upgrade standards and costs to implement HACCP (Table 9). It is estimated that the three shrimp processing plants in Nicaragua spent from US$150 to US$330 thousand to adapt to changing safety and quality standards. A total of US$105 to US$225 thousand is being spent to annually by the three plants to maintain standards and HACCP.

3.6.5.2 Government and Training-MAGFOR instituted a HACCP related inspection and certification program during 1998. It is estimated that US$139,529 was spent in personnel costs from 1999 to 2002 and that US$37,709 will be spent in 2003 for the salaries of the five individuals that conduct the program relating to fish and shrimp. MAGFOR was not able to provide cost estimates for laboratory or facility upgrades due to the implementation of HACCP. In addition, the safety and quality training provided by the Hurricane Mitch program during 2001 provided US$92,532 in shrimp safety and quality training in Nicaragua.

3.6.5.3 Total Costs for Safety and Quality-The total cost incurred by industry, government and external training programs from 1997 to 2002 ranged from a low estimate of US$382,061 to a high of US$562,061. Annual costs to maintain the program range from a low of US$187,709 to US$293,418 (Table 10). Interestingly, the primary financial obligations to remain current with seafood safety regulations and market expectations rest with HACCP compliance and maintenance of records to evidence product safety. Nicaragua has not been subjected to regulatory or market scrutiny for specific food safety issues such as the use of antibiotics (i.e., chloramphenicol, nitrofurans, or malachite green). Use of illegal antibiotics, applied for therapeutic reasons during production, has imposed significant cost on other shrimp farming regions around the world. Costs have been necessary to support very expensive and highly specialized analytical testing of finished products and tainted products have been rejected. There was no evidence to suggest Nicaragua was using illegal antibiotics. This situation reflects the youth and expertise of the Nicaragua operations which may offer a unique advantage in international markets.

Table 9.–Estimated costs to adapt Nicaragua shrimp processing plants to changing safety and quality standards and to implement and maintain a HACCP program.

Cost Category	Cost to Adapt Plant to Changing Standards and Implement HACCP Program	Expected Cost to Maintain Changing Standards and HACCP Plan
	US$	
Consultants	2,500	2,500
Employee Training	10,000	5,000
Sanitation Audits	2,500	2,500
Plant Repair and Modification	50,000	30,000
Added Cleaning Equipment	10,000	10,000
Microbiological Laboratory	30,000	30,000
Contaminant Analysis	5,000	5,000
Total	110,000	85,000
Range	Range (50,000 to 110,000)	Range (35,000 to 85,000)
Total for Three Plants	Range (150,000 to 330,000)	Range (105,000 to 255,000)

3.6.5.4 Comparison of Safety and Quality Costs Incurred with Value of Exports-The total cost to implement shrimp safety and quality standards and HACCP from 1997 to 2002 in the Nicaraguan shrimp industry ranged from 0.41 percent to 0.61 percent of the total value of exports during that same time period (Table 11). The estimated total cost to implement shrimp safety and quality standards and HACCP ranged from 1.64 percent to 2.42 percent of the average annual value of shrimp exports during this same time period[32]. The annual cost to maintain the program ranged from 0.81 percent to 1.26 percent of the annual average value of exports. The range measures from a low to a high estimate.

The only other known study to measure this cost for the shrimp industry indicated that the cost to implement shrimp safety and quality standards for the Bangladesh shrimp processing industry in 1997 was 9.4% of export sales for one year. The annual cost to maintain the program was 1.28% of annual sales (Cato and Lima dos Santos 2000) . Thus, the Nicaragua shrimp subsector has adapted to standards at a lower relative cost to sales. Nicaragua's annual costs to maintain the program are equal to that of Bangladesh at the high end of the estimate (Table 12).

[32] This ban cost the Bangladesh shrimp processing sector US$14.7 million in lost revenues (Cato and Lima dos Santos 1998). Through 1997, the Bangladesh shrimp processing sector (industry and regulatory authority) had spent US$18.0 million to upgrade the sector to minimum safety and quality standards and US$2.5 million per year was going to be spent to maintain safety and quality in the sector and for seafood HACCP programs. Subsequent inspections by the EU determined that some plant improvements met EU standards, and by the end of 1997, six plants had been approved for export. By July, 1998, 11 plants had been approved, and at the end of 2002, 48 of 65 plants licensed for export by the Bangladesh government had EU approval. The sector is also under pressure early in 2003 because of allegations that workers in the Bangladesh shrimp industry are treated poorly and that child labor is involved (UK Government 2003).

Table 10.—Estimated costs in Nicaragua to improve quality and safety standards including HACCP implementation from 1997 to 2002 and annual cost to maintain the program after 2002.

	Costs to achieve changing safety and quality standards and implement HACCP through 2002		Annual cost to maintain adequate safety and quality standards and HACCP	
	Low Estimate	High Estimate	Low Estimate	High Estimate
	US$			
Nationwide Plants*	150,000	330,000	150,000	255,000
Government**	139,529	139,529	37,709	37,709
External Training Programs***	92,532	92,532		
Total	382,061	562,061	187,709	293,418

*Total cost incurred from 1997 to 1999.
**Total exact cost incurred from 1999 to 2002.
***Exact cost incurred in 2001.

The major difference in upgrade costs as a percentage of annual sales is due to the 'starting point' for the upgrades. The Bangladesh plants were older, with older technology, and thus needed more substantial upgrades. The Nicaraguan plants were much newer relative to the time of upgrade and needed less substantial upgrading. In fact, most the processors felt the Nicaragua upgrades were more a 'cost of doing business' and just adapting to new technology as opposed to 'correcting a problem.' Once upgraded, the annual cost of maintaining standards was about identical in Bangladesh and Nicaragua.

In summary, strengths and weaknesses of hygiene and other food safety controls for the Nicaragua shrimp subsector for both the public and private sector indicate a wide range of capacities[33]. In some cases, capacities are about commercial worldwide norms, in others, they are inadequate (Table 13). Management capacity to deal with safety controls is generally adequate. Except for the small shrimp farms (which produce a low percentage of total production), knowledge of safety and quality requirements and attempts to ensure high safety standards are adequate. What is lacking are adequate financial resources for capacity building and training (Table 14).

The Nicaragua shrimp subsector has not suffered from safety and quality problems like the shrimp and fish subsectors of some other nations. The public sector has new legislation and has the knowledge and proven capability to regulate shrimp safety and quality. What is lacking are the financial resources to expand capacity in laboratories not only at agency headquarters, but in field locations near the shrimp production areas. Also lacking are the resources to hire additional trained personnel and for retraining. For the most part, the caught shrimp, large farm, and processors/exporters meet or exceed commercial worldwide norms. The small farm sector (mostly cooperatives) is in decline and generally lacks the ability and capacity to meet and

[33] The concept for Tables 13 and 14 was patterned after a World Bank study on Kenya nile perch (Henson and Mitullah 2003).

maintain adequate safety and quality standards without public sector support or support from the processors/exporters. The small farms also face other financial problems.

Table 11.—Cost of implementing and maintaining safety and quality standards and HACCP compared to the value of exports for the Nicaragua shrimp industry.

Total Value of Exports from 1997 to 2002 (US$92.6 Million)			
			Cost as Percent of the Total Value of Exports
Range of Costs to Implement Safety and Quality Standards and HACCP	Low	US$382,061	0.41
	High	US$562,061	0.61
Average Annual Value of Exports from 1997 to 2002 (US$23.25 Million)			
			Cost as Percent of the Annual Average Value of Exports
Range of Costs to Implement Safety and Quality Standards and HACCP	Low	US$382,061	1.64
	High	US$562,061	2.42
Range of Costs for Annual Maintenance of Safety and Quality Standards and HACCP	Low	US$187,709	0.81
	High	US$293,418	1.26

4.0 RECOMMENDATIONS

4.1 Additional Investments Needed to Meet International Standards

During the last three years a consolidation or 'restructuring' of the shrimp farming sector has been occurring. This has been due to a number of factors: (1) small hectarage cooperative farmers have been unable to recover from Hurricane Mitch, disease problems and the lack of technical skills; (2) bank loans have been in default and working capital has not been available; (3) the small farms are operated on 'concession' lands and there are no assets to pledge as loan collateral; (4) some farms have developed a reputation of dishonesty and have not reported all sales and thus not repaid loans; (5) several loan programs have failed due to lack of repayment; (6) both short-term and long-term credit is now almost non-existent for the small farmer, or is at high short-term interest rates; (7) the processors have developed the need to expand their own farms in order to ensure a steady supply of shrimp for processing and marketing, (8) the large farms have learned over the last five years how to manage and lower operating costs, how to reduce water quality problems and disease problems and have increased their analytical

capabilities to a level that is necessary for business survival but is probably not attainable by many small cooperative farmers.

Table 12 .Comparative cost of compliance for safety and quality upgrades and for HACCP maintenance in shrimp export industries of two developing countries.

	Bangladesh shrimp processing Period: Through 1997	Nicaragua shrimp processing Period: 1997-2002 High Estimate**
	$US Millions	
Industry facility upgrading	17.55	0.33
Government	0.38	0.14
Training programs	0.07	0.09
Total	18.01	0.56
Annual maintenance of HACCP program	2.43	0.29
Average annual value of shrimp exports during period	190.0	23.25
	Percent	
Total upgrading as percent of annual exports	9.4	2.42
Annual maintenance of HACCP as percent of annual exports	1.28	1.26

*Cato and Lima dos Santos 2000.

**Tables 9, 10 and 11.

The processors are relying more on their own farm supplies to (1) ensure a steady supply, (2) because they have more control and thus less risk of a 'bad safety and quality' event which could kill the entire market, and (3) to control production costs in a 20-year low price world market. They can also achieve economies of scale. The small cooperative growers are also like any agricultural smaller commodity producer. They focus on being the top producer and on how to increase output, not the profit maximization level of production. The small farmers also complain about the grade of shrimp given by the processor (A, B) with B lower in price. However, they think all their shrimp are A, and don't have the capability to understand that the product tests a lower grade for various reasons (broken pieces, marginally iced, etc.) Almost every time you ask them a safety and quality related question, they answer with a production related answer. A small percentage of the decline in the number of small farms and cooperatives may be safety or quality related, but most is due to natural disaster, bad credit or the inability to repay loans, lack of management skills and the 20-year low price. A high price would have covered up a lot of these problems.

Table 13. Strengths and weaknesses of hygiene and other food safety controls in the Nicaragua shrimp subsector.

Element of capacity	Public sector	Commercial Sector			
			Farmed shrimp		Processors/Exporters
		Caught shrimp	Small farms	Large farms	
Internal surveillance	Have knowledge, proven capability, but capacity limited	Meets standard worldwide commercial norms	Some capacity but generally inadequate	Above commercial worldwide norms	Average to above commercial worldwide norms
Export controls and certification	Needs known but capacity limited	Depend on processors/exporters	Depend on processors/exporters	Depend on processors/exporters	Average to above commercial worldwide norms
Responsiveness to new emerging issues	Have knowledge, proven capability, but capacity limited	Meets standard worldwide commercial norms	Some capacity but generally inadequate	Above commercial worldwide norms	Average to above commercial worldwide norms
Risk analysis	Priorities in order, HACCP implemented but capacity limited	Meets standard worldwide commercial norms	Inadequate, imposed by processors for fee	Above commercial worldwide norms	HACCP implemented
Analysis and diagnosis	Needs known but lab capacity limited	Depend on processors/exporters	Processors attempt to direct procedures	Above commercial worldwide norms	Average to above commercial worldwide norms
Control on inputs	Needs known but capacity limited	Meets standard worldwide commercial norms	Processors attempt to direct procedures	Above commercial worldwide norms	Average to above commercial worldwide norms
Pest and disease control	Needs known but capacity limited	Meets standard worldwide commercial norms	Processors attempt to direct procedures	Above commercial worldwide norms	Average to above commercial worldwide norms
Hygienic practices in production, processing and distribution	Have knowledge, proven capability, but capacity limited	Meets standard worldwide commercial norms	Some capacity but needs significant improvement	Above commercial worldwide norms	Average to above commercial worldwide norms
Monitoring	Needs known but capacity limited	Meets standard worldwide commercial norms	Some capacity but generally absent	Above commercial worldwide norms	Average to above commercial worldwide norms
Identification and traceability	Needs known but capacity limited	Meets standard worldwide commercial norms	Some capacity but generally absent	Above commercial worldwide norms	Average to above commercial worldwide norms

Table 14. Management capacity constraints relating to hygiene and other safety controls in the Nicaragua shrimp subsector.

Element of capacity	Public sector	Commercial Sector			
			Farmed shrimp		Processors/Exporters
		Caught shrimp	Small Farms	Large Farms	
Administrative procedures	Relatively new legislation but risks high of becoming overly bureaucratic	Some use of procedures and checklists to maintain on-board standards	Limited use of procedures and checklists to maintain on-farm standards	Adequate use of procedures and checklists to maintain on-farm standards	Adequate use of procedures and checklists to maintain standards
Legislation	Relatively new, adequate as written	Knowledgeable of legislation	Lack understanding of legislative intent	Knowledgeable of legislation	Knowledgeable of legislation
Enforcement and control	Inadequate number of inspectors, need specific seafood training. Some overlap among agencies	Meets commercial worldwide norms	Less accessible to authorities	Meets commercial worldwide norms	Quality assurance personnel and/or supervisors are in place and trained
Physical infrastructure	Number of labs limited, need newest technology and field labs, must rely on limited university assistance	Meets commercial worldwide norms	Inadequate/depend totally on processors	Adequate/depend somewhat on processors	Have laboratory capability and trained personnel
Human capital	Need on-going training and retraining of inspection and enforcement personnel	Fleet owners do in-house training	Training programs mostly focused on production, not safety and quality	Take advantage of available training programs, seek additional programs	Most training and retraining of personnel done in-house
Capacity-building and updating	Appropriate attempts being made to build capacity but resources are limited	Meets commercial worldwide norms	Lack practical expectations	Processor dependent	Appears to be a high priority
Communication	Some problems in communication among agencies	Some communication with public sector, could improve	Less communication with public sector and lack of understanding of issues	Some communication with public sector, also processor dependent	High level of communication with public sector

A new business model is needed that will allow the processors, the large farms and the small cooperative farmers to survive and for the industry to grow. In fact, an 'industry' does not exist as known in the developed world. An industry is currently being created with processors at the center and key to survival and growth of shrimp farming in Nicaragua. From a business perspective, banks no longer are willing to make loans to many cooperative farmers because of prior losses; some banks have foreclosed on farms with collateral, but the properties are not in use and the banks cannot sell them. In some cases, the banks have minimized losses by selling the farms at vastly reduced values.

From a development bank perspective, one scenario would be to buy the worthless debt and reorganize the productive assets into 'viable' shrimp farm projects. It would be necessary to work with and through the shrimp processors, with both the banks and processors loaning the operating farms 'inputs,' not cash, and over time recover the debt. This would also spread the risk over all participants, rather than just one of the participants. The program would also need to utilize long-term economic survival techniques: (1) in below-average years recover working capital; (2) in average years make a reasonable return to labor, capital and management; (3) in above-average years make a high return to offset the below average years. The following participants would be necessary:

Bank

- •Restructure current debt
- •Provide a part of the working capital

Owner of Asset or Concession/Small Farm

- •Make a commitment to work the farm
- •Make a commitment to repay the loan
- •Bank and processor each provide some working capital as inputs, not cash
- •Only the farmers with best capabilities could participate and over the long term good farmers would develop

Processors/Large Farms

- •Provide technical oversight, management skills, analytical capabilities and on-site oversight of ponds and harvest
- •Contract with farm for percentage of the shrimp crop in return for providing technical oversight, management and working capital inputs
- •Provide post larvae at reduced cost
- •Give discount on packing charges at the processing plant
- •Processor could amortize investment over larger hectarage
- •Would be guaranteed a certain volume
- •Small farmer cannot afford/achieve the needed technical skills; would allow the farmer to continue farming

Third-Party Financial Agent

- •Monitor contracts and process
- •Collect for the bank
- •Monitor inputs provided

Social Contribution

- •Creates lower costs, spreads the risk and places accountability on all participants
- •All agreements have legal status

Could provide

- •Health services (processors currently paying for all workers)
- •Commissary for purchasing goods at a lower cost
- •Teachers for schools, education and trained workers and farmers for the next generation

4.2 Training Needs

Currently 13 of the 15 operating seafood processing plants are on the approved HACCP list for exporting, including all three shrimp plants. For the three shrimp plants, HACCP is in place and recognized by the competent authority in Nicaragua (MAGFOR) and by the European Union (France, Italy, Spain and Germany) and by UK and Japan. In-county inspections have been made by the EU and individual companies that buy shrimp in Nicaragua (e.g., Marks & Spencer and Sainsbury's, both of UK). The US Food and Drug Administration recognizes MAGFOR as the competent authority.

As a previous performance measure, only four rejections over eight years have been experienced by the three shrimp plants involving farmed shrimp (two-*Salmonella*; one-labeling lost) and caught shrimp (one-decomposition). There have been multiple rejections for other lobster processing plants due to sanitation issues including decomposition and *Salmonella.*

Nicaraguan shrimp has met international standards, yet needs to anticipate continuing and additional scrutiny by the regulatory authorities in increasing surveillance and specification by large buyers (market trends and expectations). Thus, the following needs are suggested:

4.2.1 Government

It is critical that the Nicaragua maintain its status as a 'competent authority' in order to survive in an international market place that will become even more focused on safety, quality, transparency and traceability of product at each step from producer to consumer. This will also allow Nicaragua to 'distinguish' itself from other exporting countries and gain a competitive advantage. This will also allow the combining of quality and safety surveillance and technical support to truly advance industry development. Specific needs are:

a. Better coordination is needed among agencies. This includes MIFIC for promotions and promoting of exports, MARENA for maintaining environmental standards, MAGFOR for maintaining high product safety and quality and UCA for training and analytical capabilities.

b. Specifically, MAGFOR needs dedicated shrimp and seafood safety and quality experts in contrast to experts trained in general food safety and quality across all commodities.

c. Better analytical laboratory capabilities are needed regarding standard methods for detecting Salmonella and medications used in feed and ponds.

d. Rapid, convenient field laboratory capability is needed for screening water and shrimp samples.

e. Training is needed on how to organize and minimize the amount of bureaucracy and paperwork needed to achieve desired standards and accountability.

4.2.3 Industry (Particularly Small Farms)

It is critical that all farmers, small and large, remain current on the latest technology for sanitation and screening for potential problems. In the future, even more screening will be done and consumer reaction to medications and chemicals will have a larger negative impact. Product traceability will be demanded, not only to the farm, but to individual pond on the farm. High standards will assure quality as judged by buyers and international markets. In today's highly communicative world, one mistake or one

renegade producer can create a bad name for the entire Nicaragua shrimp sector and effectively cause all its exports to be questioned. Specific needs are:

a. Better records management and access, particularly at the small farm level to ensure traceability and accountability of the product.

b. Skills to detect and react to diseases.

c. Skills in methods to maintain quality and safety need to be upgraded.

d. Training in the appropriate use of medications and chemicals.

4.2.3 Processors/Exporters

The processors appear able to train (and prefer to train) their own employees. This ensures that training is adequate and on the correct topics. The processors do take advantage of some government training programs, e.g., technical skills in welding. A few other suggestions are:

a. Better communication is needed between the processors and small farmers on grades and standards.

b. The latest value-added techniques, sanitation methods and safety measures are needed.

c. Training aids specific to the shrimp operations and with ample visual aids in Spanish are needed.

4.2.4 Vessels

While vessel safety and quality problems appear minimal, vessel level HACCP-like programs will likely be required in the future. Thus:

a. The vessel operators and crews will need training in basic sanitation and quality standards and HACCP procedures prior to implementation.

4.3 Analytical Capabilities

A major need throughout Nicaragua is better analytical capabilities:

a. Screening methods to detect Salmonella and other bacteria must be aligned with on-vessel capabilities, field capabilities and laboratory capabilities.

b. Standard methods must be understood and available from vessel and pond all the way through to the delivery of the shrimp to the buyer.

4.4 Infrastructure

Infrastructure is a huge problem. Thus:

a. Better roads are needed to ensure product quality and safety from vessel and pond to the processing plants.

b. Better water, sewage and electrical systems are needed to eliminate the potential for product contamination, spoilage or loss.

c. Better social and community benefits systems are needed to ensure healthy and productive workers and to eliminate providing this total service as a part of the processing plants costs (and raising per pound costs and becoming less competitive in the world market).

d. Better education is needed in sanitation and ecosystem sustainability to ensure the viability of the shrimp farming industry for the next generation.

4.5 Production

The key production issues are:

a. Analysis in water quality and measuring the performance of wild-caught post larvae is needed.

b. A new and evolving business model is needed to ensure the economic survival of the shrimp subsector industry and to keep small farms, large farms and the processors involved in the farming of shrimp.

c. A genetic modification program for shrimp and a closed-system hatchery is needed in order to eliminate the introduction of diseases and bacteria from production areas outside Nicaragua.

5.0 CONCLUSIONS

The Nicaragua shrimp subsector has successfully adapted to international food safety and quality standards. Hazard Analysis and Critical Control Point (HACCP) programs have been implemented. The Nicaraguan government agency for food safety and quality has been recognized as the competent authority. Shrimp are being exported to the United States (US), to member countries of the European Union (EU) and to Japan. There have been no major shrimp safety and quality problems in international trade.

There are still needs in Nicaragua, but they relate primarily to infrastructure, better business skills for small shrimp farmers, some creative business models that will allow the small farmers in particular to remain productive and economically viable, and a recovery of the worldwide shrimp market and higher long-term shrimp prices that will allow all sectors a more reasonable profit margin. These needs are elaborated elsewhere in this report. This section points out a few unique features of the Nicaragua shrimp sector that have contributed to its success in adapting to changing worldwide safety and quality standards for shrimp and other seafood products.

Two of the three shrimp processing plants/exporters in Nicaragua are owned by US investors. One US group owns another plant in South America and major seafood interests in the US and is a long-time US shrimp company. The other is owned by a major US seafood broker/importer. The third processing plant is Nicaraguan owned, but is supplied by a fleet of shrimp trawlers owned by a US company. This fleet represents about 60% of the trawlers supplying shrimp to the processor. The owner also has trawlers operating in the US. On-site management in Nicaragua for the two US processing/exporting plants and the fleet of trawlers is by US nationals. That is, the management is part of the ownership and/or the management represents the highest interests of the company. Thus, US capital, technology and management has been imported into Nicaragua, and safe and high quality shrimp are exported to the US, the major market for Nicaraguan shrimp. The US based companies cannot afford to import unsafe or low quality shrimp into the US. This would put at risk the reputation of not only their imported shrimp but their domestically produced shrimp, and it would ruin the major market for all their products. While the processing plants and the major fleet are US owned and managed, the supervisors and employees are all Nicaraguan and jobs are provided to the local economy. One way to successfully develop a seafood export industry in a developing country may be to encourage investment and top-level management in the industry from the same country to which the products are exported.

The Nicaragua government has been proactive in updating its legislation and in adapting to worldwide safety and quality standards. There appears to be a genuine desire on the part of most of the government employees involved in seafood safety and quality to provide the highest level of government service not only to enable the shrimp exporting industry to export safe and high quality products, but to

make their government known in wider circles as responsive and for backing high standards. The 'youth' of the shrimp exporting industry has helped in that entrenched bureaucrats and practices were not in the way and adaptations could be made as the young industry matures and grows. Pressure on the government by the industry to 'do it right' has helped. However, there are still needs in the government sector to ensure that the government can fill its existing functions (e.g., more inspectors, more and better equipped laboratories, on-going training).

The importance of continued upgrading of plants to current and changing safety and quality standards was also demonstrated. It is documented that costs to upgrade shrimp processing plants in another developing country that had lagged behind in safety and quality upgrades was almost 10% of annual shrimp export sales. In contrast, costs in Nicaragua during recent years to upgrade to changing standards were less than 3% of annual shrimp export sales. Annual costs to maintain changing safety and quality standards was the same in both countries at just over 1% of annual export sales, after minimum standards were achieved through upgrading.

It has also helped that the shrimp industry is a major component of the entire Nicaragua export sector. Some other major export sectors such as coffee have been in decline and shrimp represents almost 50% of the value of all seafood exports and about 8% of the value of all product exports from Nicaragua. Shrimp has been viewed as a growth sector and is being given a higher priority for attention. If shrimp exports were 1% of exports with little growth potential, it would not have been given this attention. Thus, it is important in a developing country that seafood be a significant export commodity if it is to be successfully developed.

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7.0 LIST OF PEOPLE INTERVIEWED

The information contained in this report is based on published and cited documents, surveys completed by appropriate individuals in the Nicaragua government agencies and individuals representing companies involved in shrimp trawling, farming, processing and exporting in Nicaragua. All the surveys were provided to respondents during early August, 2003. They were completed and submitted to the research team prior to a personal visit or obtained during the personal visit. Each survey was discussed in detail with the respondents during the interviews which occurred in mid-August, 2003. This report is based on the cited information, the surveys and personal communications during the visits. The following people were interviewed:

Jeronimo Carrasco – Regional Union of Fisheries Cooperatives, El Viejo, Nicaragua
Reyes de Los Santos Cerda – Unión Regional de Cooperativas Camaroneras de Occidente – Nuevos Horizontes, El Viejo, Nicaragua
Gary Cummings, General Manager, Sahlman Seafoods of Nicaragua, S.A., Chinandega, Nicaragua
Birgit Cummings, Sahlman Seafoods of Nicaragua, S.A., Chinandega, Nicaragua
Larry Drazba, Camarones de Nicaragua, S.A. (CAMANICA), Chinandega, Nicaragua
Monica Drazba, Camarones de Nicaragua, S.A. (CAMANICA), and former coordinator of the NOAA Hurricane Match Reconstruction Promject, Managua, Nicaragua
Mario R. España, Ministerio de Fomentos, Industria y Comercio, Gerente, Manufactura Ligera, Managua, Nicaragua
Pedro Estrado – Unión de Cooperativas de Productores Acuícolas, El Viejo, Nicaragua
Hugo Alberto Farfan H., Internita, S.A., Corinto, Nicaragua
Birmania Martínez Gómez, Ministerio Agropecuario y Forestal, Departamento de Inspección y Certificación HACCP, Jefe de Area Sanidad Acuícola/Dpto. de Insp y Certi HACCP, Managua, Nicaragua
Ronald S. Herndon, President, Gulf King Services, Inc., Managua and El Bluff, Nicaragua
Emiliano Lopez – Regional Union of Fisheries Cooperatives, El Viejo, Nicaragua
Mario A. Callejas López, Ministerio de Fomentos, Industria y Comercio, Dirección General de Recursos Naturales, Managua, Nicaragua
Efrain Montano- Unión Regional of Cooperativas Camaroneras, El Viejo, Nicaragua
Christian Martinez-- Ministerio de Fomentos, Industria y Comercio, Central American Free Trade Agreement Office, Managua, Nicaragua
Bernabela Orozco, Ministerio Agropecuario y Forestal, Departamento de Inspección y Certificación HACCP, Jefe de Area Pesca/Dpto. de Insp y Certi HACCP, Managua, Nicaragua
Diego Velásquez Pereira, Ministerio Agropecuario y Forestal, Jefe del Departamento de Inspección y Certificación HACCP, Managua, Nicaragua
Orlando Rayo – Union of Estero Real, El Viejo, Nicaragua
Jaime Téfel P.—Vicepresidente Ejecutivo, Gulf King Seafood, S.A., Managua, Nicaragua
Jack Sahlman, President and Owner, Sahlman Seafoods, Tampa, Florida
Francisco Vannini, Presidente, Central American Fisheries (Corn Island), Managua, Nicaragua
Felix Alberto Vidaurre – Unión de Cooperativas de Productores Acuícolas, El Viejo, Nicaragua
Tomas Humberto Villegas – Unión de Cooperativas de Productores Acuícolas, El Viejo, Nicaragua
Marty Williams, Chief Executive Officer, Salhman Seafoods, Tampa, Florida

8.0 APPENDIX (on following pages)

Appendix Table 1: Total value of seafood exports by product type from Nicaragua, 1994-2002.

	Year																	
	1994		1995		1996		1997		1998		1999		2000		2001		2002	
Product Type	Million US$	%	Million US$	%	Million US$	%	Million US$	%	Million US$	%	Million US$	%	Million US$	%	Million US$	%	Million US$	%
Cultivated Shrimp	7.4	15.0	16.1	18.8	17.0	18.7	23.8	26.3	27.3	30.0	21.3	21.9	32.5	26.2	21.7	24.1	17.1	26.0
Caught Shrimp	14.0	27.3	22.1	25.8	20.6	22.7	16.5	18.2	22.1	24.3	22.9	23.6	21.8	17.6	16.9	18.7	16.0	24.4
Lobster (Tail)	20.8	40.5	36.0	42.0	37.6	41.4	34.8	38.5	29.4	32.3	42.2	43.4	57.5	46.4	38.1	42.2	17.1	26.0
Lobster (Meat)	0.1	0.2	0.3	0.4	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.7	0.6	0.3	0.3	0.3	0.5
Fish	8.2	16.0	8.7	10.2	11.4	12.6	11.9	13.1	11.1	12.2	9.8	10.1	10.5	8.5	11.5	12.7	12.2	18.6
Others	0.8	1.6	2.5	2.9	4.0	4.4	3.2	3.5	0.7	0.8	0.7	0.7	0.9	0.7	1.7	1.9	3.0	4.6
Total Seafood	51.3	100.0	85.7	100.0	90.8	100.0	90.5	100.0	90.9	100.0	97.2	100.0	123.9	100.0	90.2	100.0	65.7	100.0
Total Shrimp	21.4		38.2		37.6		40.3		49.4		44.2		54.3		38.6		33.1	
Total All Exports	334.6		466.0		466.0		576.7		573.2		546.1		642.8		605.0		596.3	
Seafood as Percent of Total Exports		15.3		18.4		19.5		15.7		15.9		17.8		19.3		14.9		11.0
Shrimp as Percent of Seafood Exports		41.7		44.6		41.4		44.5		54.3		45.5		43.8		42.8		50.4
Shrimp as Percent of Total Exports		6.4		8.2		8.1		7.0		8.6		8.1		8.4		6.4		5.6

Source: Anuario Pesquero y Acuicola

Appendix Table 2: Volume of shrimp caught by trawlers in coastal waters of the Pacific Ocean in Nicaragua, 1989-2002.

Year	Heads-on Pounds (000)	Number of Trawlers	Pounds Per Trawlers (000)
1989	972	26	37.4
1990	719	27	26.6
1991	327	15	21.8
1992	352	14	25.1
1993	1,063	19	55.9
1994	1,165	28	41.6
1995	1,092	22	49.6
1996	1,010	23	43.9
1997	804	23	35.0
1998	1,235	24	51.5
1999	1,723	41	42.0
2000	764	24	31.8
2001	910	19	47.9
2002	674	15	44.9

Source: Centro de Investigación Pesqueras y Acuícola (CIPA)

Appendix Table 3: Volume of shrimp caught by trawlers in coastal waters of the Caribbean Sea in Nicaragua, 1989-2002.

Year	Heads-on Pounds (000)	Number of Trawlers	Pounds Per Trawlers (000)
1989	2,114	30	70.5
1990	1,775	36	49.3
1991	1,809	27	67.0
1992	1,430	26	55.0
1993	2,211	39	56.7
1994	3,278	50	65.6
1995	4,541	55	82.6
1996	3,221	54	59.6
1997	3,318	53	62.6
1998	3,830	54	70.9
1999	3,576	49	73.0
2000	4,015	54	74.4
2001	3,710	63	58.9
2002	4,117	64	64.3

Source: Centro de Investigación Pesqueras y Acuícola (CIPA)

Appendix Table 4: Product storage in raw and finished product, freezing capacity and ice production capacity for seafood processing plants in Nicaragua, 1999-2002.

	Caribbean				Pacific				Total			
Capacity/Year	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002
	Thousand Pounds											
Storage of Raw Product	517	523	562	771	353	610	775	280	870	1,133	1,137	1,051
Freezing Per 24 Hours	120	148	117	312	297	284	263	220	417	432	380	532
Finished Product Storage	1,087	1,326	907	1,938	1,095	985	1,360	1,112	2,182	2,311	2,267	3,050
	Metric Tons											
Ice Production Per 24 Hours	187	208	141	333	344	347	150	193	531	555	291	624

Source: Centro de Investigación Pesqueras y Acuícola (CIPA)

Appendix Table 5: Total volume of seafood exports by product type from Nicaragua, 1994-2002.

	Year																	
	1994		1995		1996		1997		1998		1999		2000		2001		2002	
Product Type	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%	Million Pounds	%
Cultivated Shrimp	2.3	15.0	4.9	24.6	5.7	29.1	6.9	33.7	8.9	37.7	6.3	29.9	7.8	33.2	7.4	34.9	6.7	34.0
Caught Shrimp	4.8	31.4	6.6	33.2	5.1	26.0	4.5	22.0	5.9	25.0	5.7	27.0	5.4	23.0	4.7	22.2	4.9	24.9
Lobster (Tail)	2.1	13.7	3.2	16.1	3.1	15.8	3.2	15.6	2.6	11.0	3.4	16.1	4.4	18.7	2.8	13.2	3.1	15.7
Lobster (Meat)	0.1	0.7	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.4	0.1	0.5	0.2	0.9	0.1	0.5	0.1	0.5
Fish	6.0	39.2	5.1	25.6	5.6	28.6	5.8	28.3	6.1	25.8	5.6	26.5	5.7	24.3	6.2	29.2	4.9	24.9
Total Seafood	15.3	100.0	19.9	100.0	19.6	100.0	20.5	100.0	23.6	100.0	21.1	100.0	23.5	100.0	21.2	100.0	19.7	100.0
Total Shrimp	7.1		11.5		10.8		11.4		14.8		12.0		13.2		12.1		11.6	
Shrimp as Percent of Seafood Exports		46.4		57.8		55.1		55.6		62.7		56.9		56.2		57.1		58.9

Source: Anuario Pesquero y Acuicola

Appendix Table 6: Average value per pound of cultivated and caught shrimp exported from Nicaragua, 1994-2002

	Year								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
	US$ Per Pound* of Exports								
Export Value Per Pounc Cultivated Shrimp	3.22	3.29	2.98	3.45	3.07	3.38	4.17	2.93	2.55
Export Value Per Pounc Caught Shrimp	2.92	3.35	4.04	3.67	3.75	4.02	4.04	3.60	3.27

Source: Calculated from Appendix Tables 1 and 5.

* Per pound values for comparative purposes only since data includes all product forms and count sizes of shrimp.

Appendix Table 7: Average annual volume, value and price of U.S. shrimp imports from Nicaragua by count size, 1994-2000.

Count Size*	Quantity	Value**	Price***
Count/Kg	Metric Tons	US$1000s	US$/Lb
<33	96.84	1,061.14	4.97
33-45	76.86	784.14	4.63
46-55	31.74	362.57	5.18
56-66	57.29	552.86	4.38
67-88	148.00	1,578.86	4.84
89-110	145.21	1,320.86	4.13
111-132	343.91	2,694.86	3.55
133-164	106.06	811.00	3.47
>154	195.20	1,179.86	2.74
Prawns Peeled, Frozen	2427.09	20,150.43	3.77

* Number of shrimp per kilogram.

**Customs import value.

***Customs import value divided by volume expressed in pounds.

Source: Department of Commerce, U.S. Census Bureau, Foreign Trade Statistics.

Adapted from López, Adams and Cato (2002).

Appendix Table 8: Value and volume of cultivated shrimp exported from Nicaragua by country, 1994-2002.

	Year									
	1994		1995		1996		1997		1998	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Country	Value in Thousands of US$ and Volume in Thousands of Pounds									
Canada	0.0	0.0	30.6	108.2	182.4	739.1	0.0	0.0	34.0	123.2
China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
El Salvador	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.3	0.0	0.0
England	0.0	0.0	0.0	0.0	0.0	0.0	67.9	314.5	0.0	0.0
France	0.0	0.0	240.6	629.5	824.8	1,988.2	84.7	211.1	265.3	749.4
Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Honduras	0.0	0.0	0.0	0.0	164.5	336.6	294.7	856.4	40.0	40.0
Italy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	1.2	4.0	1,891.6	6,455.0	1,637.6	4,684.8	2,410.6	6,663.3	5,093.5	14,160.4
Taiwan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
US	1.0	3.3	2,760.8	8,922.7	2,896.3	9,271.7	4,047.7	15,754.5	3,405.5	12,245.9
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	6.0
Total	2.3	7.4	4,923.6	16,115.4	5,705.7	17,020.4	6,905.8	23,801.0	8,844.5	27,324.9

Appendix Table 8: Value and volume of cultivated shrimp exported from Nicaragua by country, 1994-2002 (continued)

	Year							
	1999		2000		2001		2002	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Country	Value in Thousands of US$ and Volume in Thousands of Pounds							
Canada	66.6	233.0	33.7	149.6	0.0	0.0	0.0	0.0
China	18.0	120.8	103.0	520.3	0.0	0.0	0.0	0.0
El Salvador	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0
England	0.0	0.0	0.0	0.0	0.0	0.0	118.9	481.9
France	88.0	228.2	296.1	963.1	153.6	279.0	126.7	217.1
Germany	0.0	0.0	0.0	0.0	165.0	776.8	86.5	189.1
Holland	0.0	0.0	0.0	0.0	0.0	0.0	176.0	319.6
Honduras	88.9	271.0	146.1	596.1	18.8	62.6	4.5	13.3
Italy	128.9	375.7	146.2	554.1	126.0	288.6	0.0	0.0
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	1,771.3	4,896.8	1,328.8	5,010.4	349.0	861.9	658.0	1,486.0
Taiwan	83.6	260.3	58.1	217.0	0.0	0.0	0.0	0.0
US	4,008.7	14,602.0	5,653.3	24,500.5	6,596.9	19,472.5	5,533.2	14,374.1
Other	79.0	275.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	6,333.0	21,262.8	7,765.3	32,511.0	7,409.3	21,741.4	6,705.9	17,082.1

Source: Anuario Pesquero y Acuicol MEDE-PESCA y AdPesca

Other includes: Belgium, Columbia, Costa Rica, Ecuador, Grand Cayman, Guatemala, Jamaica, Monaco, Mexico, Panama and Puerto Rico.

AppendixTable 9: Value and volume of caught shrimp exported from Nicaragua by country, 1994-2002.

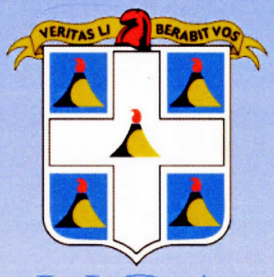
	Year									
	1994		1995		1996		1997		1998	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Country	Value in Thousands of US$ and Volume in Thousands of Pounds									
Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1	39.2
China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
El Salvador	0.0	0.0	8.9	22.1	0.2	1.1	0.1	0.3	19.0	38.6
England	0.0	0.0	68.4	243.4	26.3	129.0	0.0	0.0	14.0	98.6
France	0.0	0.0	157.5	623.0	0.0	0.0	4.0	23.6	9.6	49.6
Honduras	0.0	0.0	17.4	52.3	0.0	0.0	0.0	0.0	90.5	90.5
Italy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan	0.0	0.1	0.0	0.0	80.5	248.1	384.9	1,533.3	298.3	1,377.1
Spain	0.3	0.5	301.4	553.0	81.4	178.8	0.0	0.0	67.1	98.7
Taiwan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
US	4.1	12.3	5,765.3	19,871.5	4,867.8	19,759.9	4,071.7	14,854.3	5,286.2	20,196.2
Other	0.5	1.1	268.2	764.2	79.6	272.3	10.7	71.0	48.7	132.5
Total	4.8	14.0	6,587.0	22,129.5	5,135.7	20,589.1	4,471.3	16,482.5	5,850.4	22,121.0

Appendix Table 9: Value and volume of caught shrimp exported from Nicaragua by country, 1994-2002 (continued).

	Year							
	1999		2000		2001		2002	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Country	Value in Thousands of US$ and Volume in Thousands of Pounds							
Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
El Salvador	35.6	116.7	5.2	5.2	23.1	14.8	80.8	22.8
England	0.0	0.0	6.2	38.6	4.9	22.9	0.0	0.0
France	32.0	143.5	98.0	502.7	73.9	373.9	225.7	741.4
Honduras	53.6	75.5	2.9	2.5	0.0	0.0	0.0	0.0
Italy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan	648.4	2,944.7	418.9	1,965.0	374.5	1,511.7	316.8	1,256.3
Spain	6.6	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Taiwan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
US	4,935.0	19,580.5	4,826.2	19,282.9	4,174.9	14,868.2	4,216.1	13,852.3
Other	12.5	50.1	0.3	1.2	28.6	86.0	64.0	140.8
Total	5,723.7	22,927.6	5,357.8	21,798.1	4,680.1	16,877.6	4,903.3	16,013.6

Source: Anuario Pesquero y Acuicol MEDE-PESCA y AdPesca

Other Includes: Belgium, Columbia, Costa Rica, Ecuador, Grand Cayman, Guatemala, Jamaica, Mexico, Panama and Monaco.



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Centro de Investigación de Ecosistemas Acuáticos (CIDEA)
Universidad Centroamericana (UCA)
Apartado: 69. Managua, Nicaragua.
Teléfono: (505) 278-3930
Telefax: (505) 278-1492
Correo Electrónico: cidea@ns.uca.edu.ni
Sitio Web: http://www.cidea.edu.ni / www.uca.edu.ni